

Ontario Health Officers' Association  
Ontario Conference, Toronto, May 28-June 1

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# Canadian Public Health Journal

Devoted to the Practice of  
**PREVENTIVE MEDICINE**

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VOLUME XXV

May, 1934

NUMBER 5

**THE DEVELOPMENT OF PUBLIC HEALTH  
IN QUEBEC**

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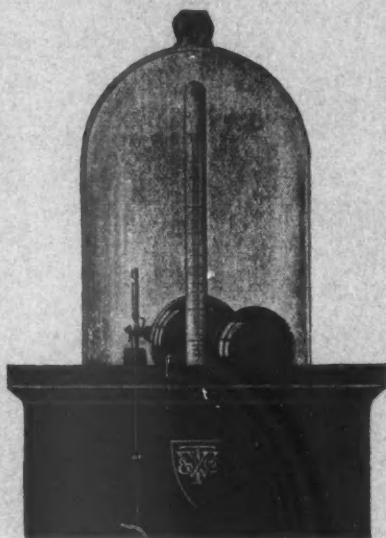
*Twenty-Third Annual Meeting, Montreal, June 11-13*

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*Published by the*  
**CANADIAN PUBLIC HEALTH ASSOCIATION**

*Editorial and Business Offices:*  
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## The Development of Public Health in the Province of Quebec\*

*By an Officer of the Provincial Bureau of Health, Quebec*

### UNDER THE FRENCH REGIME

**H**EALTH activities date from the establishment of the colony of *La Nouvelle France* more than three hundred years ago. Health *ordonnances* were promulgated and three of these are of particular interest in the light of present day regulations.

From the very beginning of the colony, parochial registration of births, marriages and deaths was regularly and faithfully conducted by the clergy. In 1667 Louis XIV issued an *ordonnance* requiring that registration be made in duplicate, one copy being forwarded to the *Juge Royal*. This mode of registration is still the basis of the recording of vital statistics throughout the province.

In 1706 the *Conseil Supérieur de la Nouvelle France* enacted regulations particularly relating to the meat supply. It was required that butchers must notify the *Procureur du Roi* of the time of slaughter, so that he might be present to verify the quality of the meat. To bring meat to the city, farmers were required to deliver to the *Procureur du Roi* a certificate from the judge, if any, in their locality, and if not, from the *seigneur, curé* or *officier de milice*, affirming that the animal was not sick, drowned or poisoned. The *Procureur du Roi* then issued a permit for the sale of the meat. The procedure parallels closely our modern system of inspection and stamping.

The third *ordonnance*, passed in 1748 by Intendant Hocquart, related to the care of foundlings. By royal command, foundlings were to be cared for at the expense of the country and the *Procureur du Roi* was required to pay special attention to the choice of wet-nurses, paying 45 *livres* for the first three months and thereafter ten *livres* a month until the child was eighteen months old. When foundlings attained the age of eighteen months the *Procureur du Roi* was required by the *ordonnance* to place them in good families until they were of age.

It must be admitted, however, that, with the exception of a quaran-

\*This is the second in a series of articles outlining the development of public health in the provinces of Canada.

tine station established at Ile aux Coudres in 1721 to guard against the introduction of plague from Mediterranean ports, no effective measures seem to have been taken against the spread of contagious diseases. Typhus and smallpox played havoc among the settlers and decimated the Indian tribes, some of which almost disappeared.

#### UNDER THE BRITISH REGIME

*From 1760 to 1887*

*(Previous to a Continuous Provincial Health Organization)*

From the beginning of British rule immigration was encouraged and quarantine measures were instituted in 1795 to guard against the introduction of contagious diseases. Until 1853, however, quarantine laws were spasmodically enforced, lapsing when the imminent danger passed. In 1800 inspection was provided at the Port of Quebec. The first isolation hospital was erected at Pointe Lévis under authority of a law passed in 1830, which also provided for the appointment of a health officer for the port of Quebec to inspect and disinfect ships. In 1832, when cholera was epidemic in Europe, the military authorities established a quarantine station at Grosse Ile in accordance with an Act of Parliament (2, William IV, c. 16) which required also the appointment of a health board at Quebec. This board was empowered to inspect ships and dwellings, to order the purification thereof, to fence streets and lots, and otherwise prevent communication in the presence of cholera. The board was required to inspect all ships and to send the sick to the isolation hospital, and had power to order the removal or destruction of cargoes. The governor could extend the provisions of the Act to the port and city of Montreal. Physicians and innkeepers were required to report contagious diseases. In 1836 Grosse Ile was bought by the government and made a permanent quarantine station. Since Confederation (1867) it has been maintained by the federal government.

One of the earliest outbreaks of a contagious disease to be recorded appeared first at Baie St. Paul in 1773 and was prevalent in the province until 1786. There seems to be no doubt that this disease, known as *le mal de la Baie St. Paul*, was syphilis, "disseminated extragenitally and innocently" (Heagerty). The Governors of the day sent physicians to treat patients at the government's expense.

*Smallpox* continued its ravages under the British rule, serious epidemics occurring in 1766, 1769 and 1783. Jenner's cow-pox vaccine was introduced in Canada in 1802 and its use was encouraged by the authorities, subsidies being voted in some instances. Vaccine was required to be kept for the use of physicians and superintendents of Indians at all hospitals receiving government aid. Parents were obliged to have their children vaccinated and from 1861 the cities of Quebec, Montreal, Trois Rivières and St. Hyacinthe appointed public vaccinators. Indigents were vaccinated without charge. Smallpox

continued to be a serious menace, being introduced by immigrants and by ships from foreign lands. In the periods of 1842 to 1854 and 1870 to 1880 it caused great havoc. In 1885 a most disastrous epidemic appeared in Montreal, in which city no cases had been reported since 1881. The records show that 19,905 cases occurred, with 5,864 deaths, of which 3,259 were in Montreal and its suburbs. The disease was brought to Montreal by a pullman car porter employed on the Chicago-Montreal train and spread to numerous municipalities. The provincial government, using the power to enforce, by proclamation, the old statute *12 Victoria c. 8*, appointed a "central board of health" to co-operate with the Montreal authorities and to control and supervise the measures taken wherever the disease might spread. The Montreal civic health board was reorganized as a result of the emergency.

### *Cholera*

In 1832 Asiatic cholera was brought to the St. Lawrence shores by emigrants from England and Ireland. At this time all of western Europe was suffering epidemics of this disease. Quarantine measures were attempted but only the sick were detained and contacts were not held, with the result that the disease was responsible for more than 2,800 deaths in Quebec and 4,000 in Montreal and vicinity. The disease was not by any means confined to these two cities. Cholera reappeared in 1834 through immigrants and caused more than 3,000 deaths; then again in 1849, with about 700 deaths in Montreal and 1,050 in Quebec. In this outbreak the disease was carried from the United States through Ontario to eastern Canada. A further outbreak in Quebec resulting in 249 deaths was traced to an individual coming from the United States and a subsequent outbreak occurred in the same city in which the disease was brought by ship from New York. In 1854, with the arrival of immigrants, a serious outbreak occurred in Quebec and Montreal. In the former 724 deaths were recorded and in the latter, 1,086.

### *Typhus*

The great epidemic of this disease in Canada occurred in 1847. It was brought over by emigrants from England and Ireland, some of whom were already ill when they embarked. The Grosse Ile quarantine accommodation was inadequate. The sheds were overcrowded. The sick and the contacts were not separated. "Of the 89,734 emigrants who sailed that year from Liverpool, 5,293 died at sea, 8,070 died at Grosse Ile and Quebec and 7,000 in and above Montreal" (Heagerty).

### *Venereal Diseases*

It is interesting to record that these diseases were made the subject of legislation in 1865. By the *Act 29, Victoria, c. 8*, medical inspection of prostitutes was provided in Quebec, Levis, Montreal, Sorel, Chambly and in any other locality which the Governor might designate. The law was to lapse after five years.

*Rabies*

*Act 20, Victoria, c. 40* (1857) empowered justices of the peace to order the isolation or the killing of dogs suffering from hydrophobia.

*Sanitation*

In 1775 Governor Carleton issued an *ordonnance* requiring the confiscation of tainted foodstuffs and the general supervision of markets in Quebec and Montreal. Provision for water works was made for Montreal in 1801 and for Quebec in 1847. In 1831, by two separate Acts Quebec and Montreal secured incorporation, with power to enact by-laws concerning sanitation. The first garbage incinerator to be built in Canada was erected in Montreal in 1885. One of the early enactments (*Act 16, Victoria, c. 174*) prohibited the disinterment of corpses within three years when death was recorded from contagious disease, and a later regulation prescribed the mode of burial in churches and the interment of persons dying from contagious diseases. Security and health of workmen in factories were provided for in Quebec under the terms of *Act 48, Victoria, c. 32*.

*Public Health Organization Prior to 1887*

By *Act 12, Victoria, c. 8*, passed in 1849, provision was made for a "Central Board of Health", to be appointed when an epidemic was threatening. No provincial organization of a permanent nature was provided for prior to 1887. By the Act of 1859 (*Act 23, Victoria, c. 61*) towns and villages were authorized to appoint boards of health with ample powers, and as a result permanent boards were established by Quebec in 1840, Montreal in 1851, Trois Rivières in 1866, Sorel in 1875, St. Hyacinthe in 1884, Valleyfield in 1885, Sherbrooke in 1887, Lévis in 1888 and Hull in 1889. The *société d'hygiène de la province de Québec* was incorporated in 1884 to enquire into the health conditions of the province, to make inspections, and to obtain reports from the local boards of health and from registrars of civil status.

## THIRTY-FIVE YEARS' ADMINISTRATION BY A "PROVINCIAL BOARD OF HEALTH" (1887 TO JUNE, 1922)

In 1886 the legislature provided for the establishing of a permanent health organization and in August, 1887, the first provincial board of health was appointed.

*Legislation*

The legislation of 1886 was found inadequate; it granted to the provincial board practically only advisory powers. It was amended in 1888 and 1890 to give the provincial board of health the power to force municipalities to appoint local boards of health and to enact by-laws which municipalities were required to execute and have executed. With these amendments, the Public Health Act of Quebec was the best of all Canadian health acts. Authority was given the

provincial board to order municipalities to avail themselves of the powers given them by any health law, by the municipal code, or by their charters, with cumulating penalties for neglect. In addition, the provincial board had power directly to execute at the expense of the disobeying municipality what it had ordered. Municipalities were thus required to reach a standard and were encouraged to utilize fully the additional powers given to them by municipal code or their charters.

#### *Municipal Health Organizations and Appointment of Provincial Inspectors*

In 1891, 839 of the 876 municipalities of the province had organized local boards of health. Many of these, however, proved to be "paper" organizations and frequent visitation from the provincial board was necessary to obtain co-operation. For 14 years after the inception of the provincial board the entire work of supervision was conducted by one able and hard working officer. In 1902 an assistant was appointed and in 1910 a plan for more adequate supervision was introduced. The province was divided into ten health districts, each comprising, on an average, 120 municipalities. Each of these districts was to be placed under the charge of a resident full-time inspector. It was required that the inspectors should hold the qualification of the Diploma in Public Health. Seven appointments were made by December, 1912, and the full quota of ten inspectors was appointed by 1916. Unfortunately some of them did not reside within their health jurisdictions. The duties of the district inspector were twofold: inspecting and advising regarding the work of municipal authorities and, through frequent conferences and health talks, educating the public as to the importance of public and personal hygiene. When contagious diseases were reported, the inspector was required to see that all measures for investigation and control were properly taken; and, if not, to undertake such measures at the expense of the municipality. As a result of the visits of the district inspectors, it was soon shown that not more than 25 per cent of the local boards of health were effectively functioning, and it is interesting to record that the substitution of "county health organizations" for small municipal boards of health was hinted at in the report of the provincial board for 1913. In the report for 1921 the board strongly recommended this radical change. The recommendation, however, was without result, even though an amendment to the Health Act in 1919 allowed municipalities to combine under one board. Thus no consolidation of existing local boards or the formation of a county health unit was effective during the administration of the provincial board of health.

#### CONTAGIOUS DISEASES

*Smallpox* was of frequent occurrence, but, with the exception of one outbreak, was promptly controlled under the direction of the district inspector. The exception was the winter of 1901 and 1902 when the disease was epidemic on this continent. Smallpox continued to spread

in the lumber camps and outlying districts. Owing to lack of funds, the board was forced to dispense with a staff of temporary inspectors. Outbreaks in shanties were most difficult to combat, the provincial board not having secured the by-law (authorized by the Health Act) to force the employers of labour to contract with physicians for the medical care of their employees in lumber and construction camps. The history of vaccination is of interest. In 1890 all municipalities were authorized to make vaccination compulsory and, through the efforts of the provincial board, 1,275 of the 1,398 municipalities in Quebec have enacted a compulsory vaccination and revaccination by-law which may be enforced any time smallpox threatens. Compulsory vaccination of school pupils was required in 1919, compliance by the school authorities being verified by the district inspectors. The so-called "conscientious objectors" are not known in the province.

### *Tuberculosis*

Until the closing year of the administration of the provincial board no special grant was provided for the establishing of dispensaries and sanatoria, the organization of these arising from private initiative. Lacking funds, the provincial board had to content itself with a wide distribution of pamphlets, the holding of conferences, the offering of free examination of sputa, and the enacting of by-laws which directly or indirectly help in the control of the disease. Active anti-tuberculosis leagues, with dispensaries, were founded in Quebec, Montreal, and Sherbrooke. Sanatoria were established at Lac Edouard and Ste. Agathe. A tuberculosis hospital was erected at Ste. Foy (near Quebec) and accommodation was provided in three hospitals in Montreal for tuberculosis patients. A Royal Commission on Tuberculosis was appointed in 1909 by the provincial government and made its report in the following year. A full programme was outlined and a grant of \$25,000 was made to the board by the government for the fiscal year 1921-22. This amount was to be expended in combating both tuberculosis and infant mortality. The board could not do more than apply two-thirds of the grant to assist existing institutions and the establishment of only two new dispensaries could be considered, one to be located at Valleyfield and the other at Rivière du Loup.

### *Epidemic Influenza*

The province contributed a large quota of cases and deaths to the pandemic of 1918. Few localities escaped; 530,701 cases were reported and 13,880 deaths were registered.

### *Scarlet Fever and Diphtheria*

The provincial board was never in a financial position to provide public health biological products for the prevention and treatment of diphtheria. Regulations regarding quarantine and isolation were provided, but isolation of the patient in a separate room proved of very little value unless conducted by a qualified nurse.

*Venereal Diseases*

The provincial government having accepted the federal government's offer of \$47,388 a year for anti-venereal disease work on the understanding that the province would expend an equal amount, the division of venereal diseases was created, with laboratory facilities in Montreal and Quebec. In the last year of the existence of the provincial board, eight free clinics had been established, 4,972 patients admitted, 52,088 treatments given, and 14,632 salvarsan injections. Illustrated lectures and wide distribution of suitable literature were used in the educational effort. Recommendations were made by the board that venereal disease should be notifiable and that the medical health officer should be given power to ascertain at any time whether venereal disease existed among inmates of houses of ill fame, but no action was taken. The Health Act, however, was amended to provide for the medical examination, previous to the passing of sentence, of all persons arrested for sexual offences.

*Typhoid Fever*

Quite a number of serious outbreaks of typhoid fever occurred during this period, most of them being water-borne in origin. The severe epidemic of 1909 in Montreal afforded evidence of the effectiveness of chlorination, which was introduced during the epidemic and resulted in the construction of two filtration plants.

*Sanitary Engineering*

The necessity for a full time sanitary engineer became evident in 1894, when plans for new water works and sewerage systems were required to be approved by the provincial board before being undertaken. The appointment, however, had to be delayed until 1908, when the division of sanitary engineering was created. In 1915 legislation enabled the board to require necessary improvements in municipal plants, the changing of the source of a water supply or treating the water and remedying ineffective chlorination or filtration. Authority was given to permit the board to take charge of the operation of a defective plant at the expense of the owners. By June, 1922, 20 municipalities had constructed filtration plants and 16 others had installed chlorinating equipment. The system of control which was established through the division, with the co-operation of the provincial laboratory, has been most effective. A daily check of all existing plants was afforded by the sending of samples of treated water daily to the provincial laboratory and the results communicated to the division of sanitary engineering. The supervision of nuisances, problems of school ventilation and disposal of factory wastes were matters considered by this division.

*Vital Statistics*

Registration of births, marriages and deaths has been regularly made in the province since 1667, nearly 300 years ago. All that was necessary in order to supply the provincial board with statistical

returns was to supplement the registration enactments by a suitable law. This law was passed in 1893 and from 1894 statistics were tabulated by counties in suitable form.

### *Laboratory Division*

Notwithstanding the small size of the grant available (\$10,000) for the entire work of the provincial board, in 1894 a modest laboratory equipment was provided. Absolutely free analyses could not at first be offered to municipalities and physicians, but much reduced fees were arranged with part-time analysts. By degrees the laboratory activities were increased, but it was not until 1910 that a satisfactory development was arrived at under the joint direction of a part-time bacteriologist and a full-time chemist and assistant bacteriologist. The work of the division of sanitary engineering, the needs of the district health inspectors, the introduction of the examination of milk and, in 1920, the creation of the division of venereal diseases, required additional facilities and staff. In the closing year of this period the laboratory examinations included 16,612 bacteriological and 4,812 chemical.

### *Health Education*

Prior to 1912 lack of funds prevented the board from supplying a well balanced programme of lectures and the work of health education was confined to the publication and distribution of literature. Since 1901 the department has published the *Bulletin Sanitaire*. With the advent of district inspectors and the creation of the division of venereal diseases, conferences and health talks were given in all parts of the province, with several anti-tuberculosis and child welfare exhibitions. Health conventions were held in the principal centres. With the appointment of a librarian and publicist, the library division was created in May, 1922. The library contains 4,000 to 5,000 volumes and is probably the best bilingual library on hygiene in North America.

### UNDER THE PRESENT "PROVINCIAL BUREAU OF HEALTH"

On the first of June, 1922, the superior (provincial) board of health was superseded by a provincial bureau of health, with a director in charge upon whom devolved the executive duties of the former board, by virtue of *Act 12, George V, c. 29*. The bureau constitutes a full division in the department of the provincial secretary. With its organization, the government voted the sum of \$100,000 a year for five years for an intensive campaign against tuberculosis and infant mortality. During the following years the appropriations for the bureau have been greatly increased, as indicated by the following figures: 1887-88, \$2,525.00; 1902-03, \$13,676.30; 1912-13, \$34,920.55; 1922-23, \$192,366.20; and 1932-33, \$960,000.00. Dr. Alphonse Lessard was appointed director and the success of the work under his direction is evidenced from a study of the annual reports of the bureau.

## COUNTY HEALTH UNITS

The outstanding feature of the development of public health work under Dr. Lessard's administration has been the substitution of county health units in charge of trained full-time officers for the feeble health organizations of small municipalities. The appreciation of the value of this provision for rural health work is at once evident when it is realized that up to the time of writing no compulsion has been employed in establishing the twenty-eight units which are now serving about half of the rural population of the province.

The original organization of health districts, with district inspectors, is being modified by the organization of county health units. Of the twenty-one health districts six are now entirely covered by health units and in eight others health units are functioning in part of the area, while in the remaining seven the work of the inspector is still carried on according to the original programme. In the six districts completely organized as county units the work of the inspector is merged. In partly covered districts the inspectors give most of their time to the portion not served by the units and co-operate with the units in the visits of travelling clinics and by lectures.

The first health unit was established in Beauce County in February, 1926; within three months a second unit was established in the counties of St. Jean and Iberville and before the end of the year Lac St. Jean was organized. In 1927 an additional unit was established and in 1928 three other county units were placed in operation. At present twenty-eight units are in operation in thirty-six counties. In 1928 a special act respecting health units was passed by the legislative assembly, providing essential legislation. The municipalities readily agreed to turn over to the province their health prerogatives and duties and to contribute to the cost of the unit on a graduated scale, reaching half the total sum in the third year of its operation. The provincial government has paid half the cost and during the first three years of the operation of a unit the Rockefeller Foundation generously gave financial assistance. In 1933 a new health unit act was passed, making permanent the existing organizations and authorizing the government to order the establishment of units in the remaining uncovered counties wherever it deems them desirable. The units will be financed by the levy of a county tax of one and one half per cent per \$100 value of taxable properties in the county and the balance of cost will be met from the provincial funds.

The county unit is a board of health in miniature composed of a full-time medical officer of health, two or more public health nurses, a sanitary inspector and a secretary, with headquarters in the principal municipality of the county. The selection of the personnel receives the greatest attention of the director and of his assistant, Dr. Emile Nadeau, who is the immediate *ordonnateur* of the units. Only qualified medical officers and nurses are appointed, the former possessing the

Diploma in Public Health; the latter, when not already certified public health nurses, are attached for at least two months to one of the units already operating and pass a qualifying examination. Sanitary inspectors are required to spend two months of special training in an existing unit or to receive acceptable training in a city department of health.

The effectiveness of the county unit is shown in the annual reports of the bureau. The whole population of the county is under constant supervision, health education and propaganda are intensively carried on and all the activities of any well balanced large city organization are included in the programme. Medical inspection of schools includes all educational institutions and is not confined to primary schools, as is commonly the practice in cities. Remarkable results in the reduction of infant mortality have been recorded. In the 8th annual report the director was able to state that for the seventeen counties then provided with health units the infant mortality rate, which was 141 in 1926, had been reduced to 106 in 1929. For the year 1932 the rate had fallen to 86.

#### CHILD HYGIENE AND TUBERCULOSIS CONTROL

Under the direction of Dr. Lessard and with increased appropriations, intensive effort was made to reduce the high mortality among children in the first year of life. By 1925, 17 social health centres (dispensaries) and 50 other clinics had been organized or subsidized by the provincial bureau. A year later two additional health centres were provided, so that one health centre was available in each of the cities of Quebec, Trois Rivières, Sherbrooke, Hull, St. Jean, Joliette, Valleyfield, Lachine, Chicoutimi, Rivière du Loup, Thetford Mines, St. Jérôme, Arthabaska and Gaspé, with five in Montreal. Summer camps are maintained by four of the health centres.

Being head of the provincial department of public charities as well as director of the provincial bureau of health, Dr. Lessard was able to have the number of hospital beds for tuberculosis increased in three years from less than 300 to 1200. Travelling anti-tuberculosis and child welfare clinics serve the thirty-six counties covered by health units. The staff of the travelling anti-tuberculosis clinics consists of five specialists supplied with portable X-ray equipment. In 1932 30,000 persons were examined by the clinic. As units are established, the existing social health centres and clinics are incorporated into the organization of the unit.

#### *Foster Family Placing of Children*

In September, 1929, authority was granted for the institution in the province of *le placement familial pour la préservation contre la tuberculose*, as introduced in France by Grancher.

"The system consists in the removal from the infected city home of a

child exposed to contagion from his father or mother suffering from open tuberculosis and placing him in the family of a farmer who has no children or whose children have grown up and left home. There the child is raised as a peasant, acquires a taste for rural life, goes to the local school and later, as observed in France, there is considerable probability that he will remain on the land, a farmer like his foster-family, healthy, robust and forever freed from the danger to which he would have been exposed had he remained in the city." (Ninth Annual Report of the Director.)

Differing from the plan in France, the whole undertaking is directed by the provincial bureau, the province supplying all the costs, which comprise clothing, school fees, medical care, and \$8.00 monthly to the foster family. The selection of suitable families is made jointly by the curé and the local physician. A nurse visits the children from time to time.

#### CONTROL OF COMMUNICABLE DISEASES

In 1927 a severe epidemic of typhoid fever occurred in Montreal, resulting in 5,353 cases. The origin was traced to a typhoid carrier employed in the pasteurizing plant of a dairy supplying milk to about one-eighth of the city's population. The provincial bureau gave every possible assistance to the city health service and a most complete and thorough investigation was conducted. The need for more adequate legislation was evidenced and provisions have been inserted in the Public Health Act which require that plans for pasteurization plants must be approved by the director of the provincial bureau before construction is undertaken; that the director can close all plants which are inefficiently operated unless conditions are corrected; and that employees in pasteurization plants shall undergo medical examination.

In 1921 a division of epidemiology was created with an expert epidemiologist in charge. The need for the division had been long felt and its organization is making possible detailed studies of such subjects as rural typhoid. Such a fact that in almost half of the cases reported the source of the infection had not been determined indicates the need for this division.

#### *Diphtheria*

The fall in the death rate from diphtheria in the province of Quebec has been most striking. From the high point of 144.6 per 100,000 population in 1895, the death rate fell to 28.4 in 1922. At that time the provincial bureau of health was organized with a greatly enlarged programme of child hygiene. The organization of county units made possible an intensive campaign of immunization commencing in 1900, with the result that the death rate from this disease for the entire province for the year 1932 was 6.5.

*Venereal Diseases*

As previously mentioned, the division of venereal diseases was organized in 1920, providing facilities throughout the province for the treatment of all cases and conducting an active programme of public education through lectures and pamphlets. Owing to the gradual decrease of the Dominion government's subsidy and its discontinuance in 1931, the educational programme of this division has been curtailed and the available funds have been utilized for new treatment centres. By 1931, 82 treatment centres had been provided for those who could not meet the expenses of treatment by their own physician and who may, through the dispensary, receive treatment free if they are temporarily unable to pay. Valuable social data are being collected, indicating that the source of infection in 37 per cent of the cases was from commercialized prostitution; from clandestine prostitution, 45 per cent; congenital, unknown or accidental, 11 per cent; and in marriage, 7 per cent. The services of the provincial laboratory are absolutely free. In 1931, 294,782 treatments were given in the dispensaries and 115,786 injections, 66,681 blood tests in the provincial laboratories and 20,454 tests in hospital laboratories.

## SANITARY ENGINEERING

The work of the sanitary engineering division has steadily increased, being five to six times what it was prior to the organization of the bureau. Its various activities include supervision of water supplies, sewage disposal plants and sewerage systems, milk pasteurization, housing, the abatement of nuisances and general sanitation. All filtration and water chlorination plants in the province are under the supervision of the chief of this division. Not only are daily samples of treated water examined, but one of the assistant engineers is engaged in the inspection of such plants and completes the training of operators when necessary. It is hoped that all operators will be required in future to pass a qualifying examination of competency. Of the 606 public water works in the province of Quebec, 204 are using rivers (population supplied 1,526,300), 71 using lakes (population supplied 106,800) and 331 using springs or wells (population supplied 190,000). Sixty-six municipalities with an aggregate population of 1,205,700 receive filtered water and, in addition, 38 municipalities (aggregate population 284,800) are protected by chlorination. The fall in the typhoid death rate from 25.5 per 100,000 population 15 years ago to 6.8 in 1932 bears evidence as to the effectiveness of the control. An important amendment to the Health Act prohibits new cross-connections in municipal supplies unless approved by the director of the provincial bureau and authorizes the department to order the discontinuance of existing cross-connections. Similarly, milk pasteurization plants are under the supervision of the division.

## LABORATORY

In 1928 a remarkable expansion in the laboratory work reaching a total of nearly 52,000 examinations required a reorganization of the division into three sections, a laboratory of chemistry and sanitation, a laboratory of bacteriological diagnosis, and a laboratory of serology. These three divisions were co-ordinated under one head, the chief of laboratories. The rapid increase in the number of county health units brought a further increase in the number of specimens for examination, the total reaching 138,074 in 1932. Thus from the very humble beginning of the laboratory service in 1894 has developed a division of laboratories occupying two floors of the spacious building, with a staff of about 40 physicians, chemists and technicians who are making more than 1,500 examinations every month. In addition to the regular work of the division, more than 25 litres of human convalescent serum for the early treatment of poliomyelitis was prepared and distributed during the years 1929-32.

## VITAL STATISTICS

In 1926 the Public Health Act was amended to permit the use in Quebec of forms for the returns of births, marriages and deaths similar to those in use in the other provinces of Canada, thus making possible the publication by the Dominion Bureau of Statistics the vital statistics for the whole of Canada. The forms which were in use had been introduced in 1894 and required much less information than the new ones. From 1894 to 1926 the statistician, being without clerical staff, could do little more than compile the death returns by counties. With the adoption of the new forms the division was reorganized and a statistician with special training in public health was appointed. Payment of fifteen cents for each return was introduced at that time. A radical change was also made in taking the population figures from the annual parochial census instead of from the federal decennial census, the object of the change being to dispense with estimated populations between the federal census years.

## UNORGANIZED TERRITORIES

The sparsely populated north shore of the St. Lawrence River and the unorganized parts of the province have, since 1925, received special attention from the provincial bureau. Seven nurses are located at strategic points on the north shore. At Hâvre St. Pierre the department of public charities has established a hospital with a resident physician, supplementing in this way the work of the nurses. The sanitary conditions of the lumber camps and the new mining areas are supervised by two sanitary inspectors.

# Cross-Connections in Municipal Water Supplies in Ontario\*

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THE term "cross-connection" may be defined as a connection between two waterworks systems which may permit the use of either or both supplies, or as "any physical connection by means of which water may flow between a public supply and a non-potable supply"<sup>1</sup>. Wherever an auxiliary source of water supply is available, it may be said that a potential cross-connection exists. A typical cross-connection results when a municipal domestic system, normally used for the requirements of a mill or factory, and an auxiliary fire supply, secured from a river or pond, are directly connected. Where large volumes of water are required for manufacturing use, an auxiliary supply is often provided for economic reasons. The inadequacy of either the public domestic supply or the auxiliary supply also results in cross-connections being made.

## TYPES OF CROSS-CONNECTIONS

The various connections within industrial plants are numerous; in fact, there does not appear to be any limit to the cross-connections which may exist.

The following are the more common installations:

### (1) *Connections within Industrial Plants*

#### (a) *Boiler Feed Lines:*

Boiler feed water heaters.—The primary and auxiliary supplies are connected into a common pipe feeding into the heater. Boiler feed pumps.—The two supplies are directly connected at the pump suction. Direct feed.—The two supplies are connected directly to a common feed line into the boiler.

#### (b) *Condensers:*

The operation of condensers requires a never failing water supply and for this purpose two separate sources are desirable.

#### (c) *Compressors:*

Two sources of supply of cooling water to air compressors are desirable and consequently cross-connections are made.

### (2) *For Fire Purposes*

#### (a) *Gravity Tank Supplies:*

The usual cross-connection for sprinkler systems consists of a connection between the domestic mains and an overhead storage tank. The latter is filled with water from the domestic lines and automatically supplies pressure to the sprinklers, should the primary supply fail.

#### (b) *High Pressure Fire Pump Systems:*

There also may be combinations of the two systems. The high pressure fire supply presents a more serious problem in relation to public health. This is particularly true where the auxiliary supply is heavily contaminated.

\*Abstract of a paper presented at the annual meeting of the Public Health Engineering Section, Canadian Public Health Association, Toronto, May, 1933 (joint session with the Ontario Health Officers' Association).

<sup>1</sup>Am. Waterworks A.J., March, 1933.

Examples of this type of fire protection are as follows:

- (i) A storage reservoir filled from the domestic system for supplying the fire pumps.
- (ii) Fire pumps supplied directly from contaminated sources. This type of connection presents a potentially dangerous situation.
- (iii) Fire pumps taking suction directly from the domestic mains in conjunction with overhead storage tanks.

(3) *Other Cross-Connections*

A connection which is often overlooked may be found at swimming pools of the recirculation type. Water feed inlets to the pool may be so located or arranged that siphonage of pool water into the domestic supply may be possible.

Other unnoticed connections may exist in sewage disposal plants or sewage pumping stations where domestic water lines are connected to the sewage pumps for priming purposes.

### EPIDEMICS DUE TO CROSS-CONNECTIONS

The disastrous results of cross-connections are quite evident. The report of the No. 8 Committee of the American Waterworks Association records 26 outbreaks. Two examples of cross-connections with a municipal supply are cited.

(1) *Bloomington, Illinois, January, 1920.*

Industrial supply of Chicago and Alton shops cross-connected with city supply. The creek from which the industrial supply was obtained went dry and a 33-inch sewer main was tapped. A leaky valve permitted this sewage to enter the municipal supply. There were 300 to 400 cases and 15 deaths from typhoid. (*Engineering News Record*, v. 84, no. 939.)

(2) *Everett, Washington, 1923.*

Polluted industrial supply entered through an open 6-inch gate. Drop in city pressure caused introduction of polluted water through open 6-inch cross-connection with industrial supply. Two thousand cases of diarrhoea; 77 cases and 11 deaths from typhoid. (*Journal of the American Waterworks Association*, 15: 477.)

The list also contains a number of severe outbreaks where the connections were through check-valves which leaked or failed to operate and 8 epidemics due to auxiliary intakes and by-passes.

### *Ontario*

In 1918, in the city of Chatham, interconnection of the municipal supply with an industrial supply pumped directly from the heavily polluted Thames River was responsible for 162 cases of typhoid fever, with 16 deaths. In 1929 in Cornwall 7 cases of typhoid with 2 deaths were attributed to cross-connections between a mill supply line and the municipal service. In 1932 in London the existence of a number of small cross-connections between the municipal supply and a supply pumped from the Thames River for industrial use was suspected as being responsible for the severe intestinal disturbances experienced by a number of the employees of the plant affected. Fortunately no cases of typhoid were reported.

These outbreaks arose from cross-connections in industry. There are no epidemics on record in Ontario from cross-connections for fire protection purposes.

## LEGISLATION

Supplementing the Provincial Departments of Health in the supervision of public water supplies is the supervision exercised by the Federal Department of Health in connection with interprovincial and international travel. The Public Health Acts apply in a general way to cross-connection installations. Two provinces, Quebec and Ontario, have special regulations. The remaining provinces report that the situation does not demand special legislation, since no cross-connections are known to exist. The exception to this is Manitoba, where a connection exists on each of two old waterworks systems which are fully protected. The Department, however, will not permit of new installations having cross-connections.

The Quebec provincial law, which is an amendment of Article 56 of the Public Health Act, is as follows:

"No cross-connection can be made between the conduits of a public water supply and those of a private system before submitting plans and specifications to the director of the Provincial Bureau of Health and obtaining the Bureau's approval.

"Plans and specifications of existing cross-connections shall be submitted to the director of the Bureau before the first of January, 1934. These cross-connections shall be modified or eliminated when, in the opinion of the director, they constitute a danger to the public health."

The city of Montreal passed a local by-law in October, 1932, governing cross-connections.

*Ontario*

In Ontario provincial legislation came into force July 6, 1921. The regulations refer to cross-connections between a potable municipal supply and a private water supply system. They do not cover undesirable cross-connections which frequently exist within the municipal system itself but which should not be permitted. The onus of enforcement of the provincial regulations has been placed on the local authorities. The main features of these regulations are as follows:

All connections between non-potable auxiliary supplies of any nature and municipal supplies are prohibited, except those connections installed for fire protection only. Provision is made for the inter-connection of two supplies where the Provincial Department of Health certifies that the auxiliary supply is of satisfactory quality or satisfactorily protected for domestic use. Cross-connections for fire protection are dealt with under three headings, according to the source of the auxiliary supply. Where this supply was secured from an overhead tank filled from the municipal mains, the installation of dual check valves of special F.M. type fitted with the necessary testing devices was required within two years of the enactment of the regulations. Similar action was required at those plants where a storage reservoir had been installed as a secondary source of supply. In addition, these reservoirs were to be filled either from the municipal system or from a supply of satisfactory quality, and protected against contamination. On all connections between auxiliary supplies from a separate source and municipal systems, the installation of dual check valves of special F.M. pattern was required within six months from the passing of the regulations.

By the application of these regulations, if, on the examination by the Provincial Department of Health, any source of private supply could not be approved as being of

satisfactory quality or satisfactorily protected for domestic consumption, the corporation so affected faced three alternatives within two years from the passing of the regulations:

- (a) Treatment of the auxiliary supply so as to secure approval of the supply as satisfactorily protected for domestic use.
- (b) Abandonment of the contaminated auxiliary supply and installation of an overhead tank or storage reservoir filled from the municipal system.
- (c) Disconnection from the municipal supply.

Shortly after the enactment of the regulations, a special ruling was made in regard to those installations where the auxiliary supply was secured solely from an overhead tank. Permission was given for the installation of two regular type fire underwriters check valves on these connections. In view of the unsatisfactory performance of a single check valve of this type, the additional protection afforded by two of these valves is problematical.

#### ONTARIO SITUATION

##### *Survey of Conditions*

In 1924 a survey of the province was made by the Department to ascertain to what extent the regulations of 1921 had been met. This survey included all the province except the city of Toronto, which was omitted because the local officials had taken active steps to secure enforcement of the regulations. Particular attention was paid to those plants where the auxiliary supply was secured from a storage reservoir or a separate source.

In all, 120 plants, maintaining 163 cross-connections, were inspected. Ninety-two of the connections were protected by means of double check valves of special F.M. pattern and 14 each with double check valves of the regular type. On 47 connections there were single checks only and 7 connections were controlled by gate valves. The elimination of three connections had been secured.

Samples were collected from all reservoirs and auxiliary supplies taken from a separate source. In the majority of cases, the auxiliary supplies, when secured from a separate source, could not be approved by the Department. Eighty-two corporations, eleven of which had reservoirs filled from a separate source and the remainder taking suction directly from the separate source, were involved.

During the survey it became apparent that, except in one or two isolated instances, no attempt was being made by the local authorities to report on the existence of all types of cross-connections which may be installed for industrial or other purposes. These connections are usually small, ranging in diameter from half an inch to four inches, but since they are generally controlled by gate or globe valves the protection of the municipal supply against contamination is slight. In the aggregate such connections probably constitute a far greater health hazard than those provided for fire protection, which, though much larger, receive a certain measure of supervision. All waterworks officials should bear in mind the fact that every corporation which is served by the municipal supply and maintains a privately operated system is a potential harbourer of an illegal cross-connection. In 1924 85 connections of this nature were discovered in 55 plants.

As an example of the problem encountered in a large municipality, the

city of Toronto may be cited. At the present time there are 157 corporations with gravity tanks alone as an auxiliary source of supply. These plants have 168 tanks and 197 fire service connections. There are 26 private pumping systems, 4 of which take suction from the city main and have a gravity tank as an auxiliary source. In the remaining 22 cases the pumps take suction from storage reservoirs and 3 of these plants have gravity tanks as well. All cross-connections are protected by double check valves and a regular inspection is made at least twice yearly.

Following the survey, offending companies were notified that the source of their auxiliary supplies could not be approved by the Department and they were requested to make the necessary changes. This request brought strong objection from the fire underwriters associations, with the result that, while the installation of double check valves has proceeded in a fairly satisfactory manner, very little has been accomplished in the elimination of these hazardous connections. No new connections of this nature, however, have been permitted.

In the fall of 1932 a survey of the situation in London was made and 27 cross-connections of various kinds other than for fire protection were found in 17 plants. An energetic campaign is being waged by the local waterworks officials to secure the elimination of these cross-connections and considerable progress has already been made. A similar survey should be instituted by all local bodies with a view to securing compliance with the provincial regulations.

#### *Cross-Connections for Fire Purposes*

The importance of an auxiliary source of supply for fire protection is well recognized and if it is secured from an inexhaustible source its value is so much greater. The necessity for such a supply does not loom so great if the primary supply, *i.e.*, the municipal one, is brought to the plant through a well gridded system and is secured from an inexhaustible source or has an adequate reserve for fire protection. One of the chief requirements of an efficient fire protection system is, obviously, that of applying water to a fire as soon as possible after it has started. This is provided for by the design of the sprinkler system and if this is not at fault any fire which may start will rarely gain such headway as to require the services of auxiliary pumping equipment for many hours before it is brought under control. It is interesting to note that where an auxiliary supply from a lake or stream, etcetera, is not available and emergency pumping equipment is deemed necessary, a reservoir with capacity equivalent to two or three hours' discharge of the fire pump is accepted by the fire underwriters.

It is our opinion that where the source of municipal supply is reliable and the distribution system cannot be considered reliable or the supply is limited, special consideration may be given and it may be necessary to permit the maintenance of cross-connections under a system of rigid inspection. At the same time, steps should be taken by the local authorities to make improvements to the municipal supply so that these cross-connections may be eliminated as soon as possible.

*Protective Measures on Industrial Connections*

The provincial regulations provide only one method of utilizing the municipal supply as an auxiliary to a private industrial system, namely, by means of an open discharge into a storage tank, the discharge to be located above the highest water level. In the few municipalities where the officials were alert to the potential dangers of these conditions, one or more of the following expedients are used to protect the municipal supply against pollution.

(1) A four-way stopcock with a butterfly plug is inserted at the junction of the municipal and private supplies. The two supplies enter from opposite sides of the stopcock; the third opening feeds the industrial distribution system, while the fourth is an open end discharging to waste. This makes it necessary to shut off the supply which is not in use by means of a globe or gate valve, thus providing a short length of open pipe separating the two supplies. Should the four-way stop-cock leak, the leakage will discharge to waste. One or two check valves should also be placed on the municipal service. This precaution is taken to protect the municipal system when it is in use in the plant. Should this system fail at this time, polluted water from the plant industrial system might flow back into the street mains if a check valve is not provided.

(2) A swing joint is provided at the point of dual application and one supply must be disconnected while the other is in use. Check valves on the municipal service are also recommended for the same reason as given in No. 1.

(3) A tee with a replaceable plug with a shut off valve on each side of it is placed on each feed line. When the industrial supply is being used, the tee on this line is plugged and both valves are open, while in the municipal service both valves are closed and the tee unplugged.

(4) The two supplies are disconnected by means of the removal of a short length of pipe which is kept at this point, and may be replaced when occasion arises.

There are certain objections to the third and fourth devices in so far as their efficiency depends entirely upon the zeal of the employees of the plant, and the necessity for regular inspection and constant supervision on the part of local authorities cannot be too strongly urged. This inspection service should include all plants which maintain a private supply system, whether or not a cross-connection is known to exist. Changes in the internal piping systems are frequently made and it is only by maintaining constant supervision that local officials can be sure that illegal cross-connections have not been made. The Department regulations require that the various piping systems inside the factory be painted distinctive colors. This should be insisted upon, as it facilitates greatly the work of inspection and guards against the making of cross-connections inadvertently by employees not familiar with the plant layout. In order that some standard markings may be adopted, it is suggested that those recommended by the Canadian Engineering Standards Association be used.

There is only one installation in the province of the recently developed automatic start-and-stop chlorinator which has been especially designed for connection to fire pumps. This machine was installed in the fall of 1932 and has not as yet seen sufficient service for the Department to pass upon its merits. Two other supplies which are used both for fire and industrial purposes are protected by chlorination.

*Installation of Valve Pits or Chambers*

Nine installations of dual check valves were inspected recently by the authors and only one chamber was found which might be termed as being satisfactorily built. These pits should be large enough to permit easy access for inspection purposes. Ample room should be available for operation of the gate valves if these are in the pit, and also for dismantling the valves for examination and cleaning. They should be located, if possible, where traffic does not interfere with their inspection. They should also be of watertight construction and adequately drained or facilities provided for unwatering. Accumulation of water in the chamber should not be permitted. The pressure gauges might well be removed to a dry place and kept in serviceable condition. Where pits are improperly built and it is difficult to examine the valves, there is a tendency towards neglect, and inadequate supervision follows.

## CONCLUSIONS

Complete separation of potable and non-potable supplies is the only method whereby the potable supply can be maintained absolutely safe. All cross-connections between such supplies should be severed, except perhaps those connections for fire protection, where the municipal supply is unreliable or inadequate. In these latter cases, necessary improvements and extensions to the potable supply should be made so that these connections can be eliminated without undue hazard to life and property.

The crux of the situation in regard to protective appliances on cross-connections, namely, double special check valves of modern design with or without automatic start-and-stop chlorination apparatus, appears to be whether or not they function effectively at all times.

Regular inspection of all double check installations should be made at least quarterly by local authorities. A yearly inspection by provincial representatives would probably be of considerable assistance to the local officers.

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Twenty-Third Annual Meeting  
MONTREAL, QUEBEC  
June 11th to 13th, 1934

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*Programme on page 240*

# A Full-Time Rural Health District

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**I**N June, 1931, two full-time health districts were instituted in Alberta, one in the southern part of the province at High River and a second at Red Deer, in central Alberta. These units are organized on similar lines.

The Red Deer full-time health district lies in an essentially agricultural region and consists of 5 municipal districts with 10 cities, towns and villages situated within their boundaries. The total area is 1,700 square miles and the population at the 1931 census was 18,719, of which 6,025 were residents of towns the population of which ranged from 2,344 in the city of Red Deer to 84 in the smallest village. Over this district are distributed 83 rural schools, with an average of 24 pupils per school. The total school population in these and in our town schools is 4,035. There are also within our district two lake resorts, one of which has a summer population of more than 10,000 people. These, of course, create a special problem in public health.

The health district is controlled by a district board of health, composed of one appointed member from each municipal district, city, town and village in the area; this board meets quarterly. The personnel of our unit consists of a medical officer of health, two nurses, a stenographer, and a part-time sanitary inspector.

The time of one nurse is employed chiefly with follow-up work in the homes, while the second nurse spends the greater part of her time in clinic work with the medical officer. The sanitary inspector divides his time between the two units in the province, alternating each fortnight. This leaves a certain amount of emergency sanitary work for the attention of the medical officer during the interval of absence, but it is a reasonably satisfactory and economical arrangement. The stenographer has been trained as a reliable and skilful assistant in the routine procedures carried out in our laboratory, releasing the time of another member of the staff for field work.

Accurate recording of all work done, and of various circumstances met in the course of our work, is, we feel, essential; but, with a limited staff, the simplest system that can be devised to keep this information in an orderly manner seems very necessary. If thought is not given to this matter it is surprising how recording becomes so complicated as to encroach unduly upon one's working time.

The chief activities in this organization are summarized herewith.

## *Public Health Education*

It is evident that education of the public is the foundation upon which our structure of public health work must be built. It is not difficult to persuade most parents who have made some study of the problem that it is advisable that their boy or girl should be vaccinated against smallpox, but we have all found difficulty in convincing the person whose information on the

subject was limited to the legend of "blood-poisoned" arms, etc., which had been handed down to them by their parents or grandparents. Here, especially, public health education is required.

We are inclined to neglect the educational work in favour of the more concrete effort of immunization, examination, etc., but it is profitable to keep in mind that persistent education makes such measures much more widely applicable.

In our unit we approach the public through newspaper articles; a monthly letter containing news of our organization and discussion of health topics, which is sent to some 37 women's organizations of our district; health talks to various groups of adults and to school children, and organization of classes amongst older school children and adults for demonstration-lectures in home nursing and first aid. We publish a small monthly health journal which is sent to each school in our district. The material is sent to us by the pupils themselves in the form of stories, poems, playlets, cartoons, etc., on health subjects. Much interesting and clever material is submitted and the children show great interest in the publication. We believe it an excellent medium for promoting interest in health habits.

Probably the greatest opportunity for educational work is that offered our nurse doing follow-up work in the homes.

#### *Physical Examination*

Physical examination of all school children was carried out two years ago (our first year of operation), and is being carried out again this school term. In the rural schools, parents are invited to attend the school at the time of our visit, and to bring babies and pre-school children for examination also. Carrying this service to such small areas has enabled us to see a high percentage of this younger group, who are taken care of in the towns by special baby and pre-school clinics. A report of each examination is sent to the parents and follow-up visits are made by our nurse where indicated.

A few life extension clinics have been held for adults. Such of these as available time has permitted may, we believe, have an educational value in bringing this important preventive measure before our people.

#### *Control of Communicable Disease*

We investigate all outbreaks of communicable disease and institute such measures as are necessary. Each case is seen by a member of our staff before release from quarantine. Daily inspection of the children in the school rooms where a case of communicable disease occurs has proven for us a most efficacious means of curbing epidemics.

With the co-operation of the staff of our provincial sanatorium, we have instituted clinics for yearly examination of the contacts of tuberculosis in our district. In the interval this group is kept under supervision by our visiting nurse, and further examinations are made if indicated.

Immunization against smallpox and diphtheria has been carried out in all

schools and at the present time more than 80 per cent of our school population is immunized against both diseases.

In our rural districts parents have been invited to bring pre-school children for immunization with the school group, and special clinics for this purpose have been held in the towns during the summer in an effort to reach the younger children. The results have been very satisfactory and we receive an increasing number of requests for immunization of pre-school age children. But in spite of all that has been said to the public on this matter, we still meet numbers of parents who have the impression that it is "better to leave them until they are older".

#### *Sanitation and Food Control*

In this field we have found much to cultivate. Sanitary surveys of all public water supplies were made, including those of our rural schools, and bacteriological analyses are made periodically. This has also been carried out with private supplies in towns where congestion increases the possibility of contamination, and with a limited number of private supplies in the rural areas. When wells are found contaminated, instruction is given to owners regarding sterilization and subsequent protection of the well; if the contamination is subsurface the wells are, of course, condemned. The unit has been instrumental in introducing chlorinating equipment in our only city using a surface water supply.

Previously little or no attention was paid to the quality of milk delivered in our district. A first step in control was to have each town council pass a by-law requiring all milk vendors to be licensed, where this had not already been done, and to incorporate in the by-law the requirement of having each dairy herd tuberculin tested at least once a year.

All dairies are inspected periodically and samples of each dealer's products are analysed in our laboratory for butter-fat and bacterial content. At the present time the herds of almost all dairy men are tuberculin tested. A general improvement in the quality of milk sold in our district has been noted since these measures were instituted.

All food-handling establishments are inspected regularly, and other public and private premises as indicated.

Surveys are also made of our school rooms, and while such economic times prevent much improvement by school boards, yet numbers of our older schools with cross-lighting have improved the condition by a small expenditure on window blinds and old chipped blackboards have been replaced at a cost within reach.

Owing to rather poor sanitary arrangements in the lake resorts of our district, considerable supervision is necessary during the summer months. However, the summer cottagers have appreciated the advantage of a fly-proof privy, and shallow wells are being rapidly replaced by community drilled wells. Strict regular inspections of milk and other food supplies are now made.

In all this sanitary work, in a rural community where sanitation previously

had been left much to the judgment of the individual citizen, we have been greatly pleased with the co-operation of the people. We believe that this has been increased by a tolerant and educative approach to the problem.

### *Laboratory*

We have at our service a fully equipped provincial laboratory in the city of Edmonton and within such easy access as to give our district prompt service under most circumstances. For this reason the laboratory in connection with the health unit is designed chiefly to meet the needs of sanitary control. Bacteriological analyses of water and milk and butter-fat estimation of the latter form the bulk of our routine work. A sedimentation disc preserved in cellophane and exhibited to the dairymen or to the local boards of health has been a powerful instrument in our experience in developing a clean milk supply.

We also undertake the culturing of throat swabs and other emergency bacteriological examinations, as well as such blood counts, urinalyses, etc., as are required in connection with the work of physical examination.

### *Cost*

Our health district was instituted by the provincial department of health, with the co-operation of the Rockefeller Foundation and the municipalities concerned, and the continued interest and assistance of these organizations has done much to facilitate our work.

The yearly budget is \$10,000 and for the initial period of three years 50 per cent of this is paid by the provincial department of health, 25 per cent by the Rockefeller Foundation, and the remaining 25 per cent by the people of the health district. At times we have felt that our budget is rather too restricted. Contemplating the many avenues of effort which might to advantage be incorporated in a public health programme and for which funds are not available, we are prone to become impatient. But probably it has the virtue of leading one to apportion money and time more carefully and to choose with the greatest care those lines of effort which will result in the greatest health dividends for the people.

Most public health workers will agree, I think, that the greatest trial to patience, and a frequent source of disappointment, is the inertia of the public in respect of health. The otherwise intelligent citizen is sometimes dull and unresponsive when we expound to him certain values and principles of preventive medicine. But many such citizens, when they have grasped these principles, or when the lesson has been brought home to them perhaps by some unfortunate incident touching their own family or friends, become our most staunch supporters. Does not this suggest that we might profitably spend more time, much more of our time than we have thought necessary in the past, on public health education? We have the straw; we feel that we can make pretty good brick: but to what purpose unless we prepare our market?

# The Distribution of *Brucella Abortus* in the Infected Udder\*

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OUR knowledge of udder infections with *Brucella* organisms dates from the work of Horrocks (1), 1905, who demonstrated the presence of *Br. melitensis* in the milk of goats. The work of Zammitt (2), 1905, and of Horrocks and Kennedy (3), 1906, showed ten per cent of the goats at Malta to be excreting the organism in the milk; these workers, however, did not state the definite source of the milk examined; apparently mixed samples were used. Zwick and Krage (4), 1913, reported that the intramammary injection of *Br. abortus* in goats resulted in its excretion in the milk for a period of 3 to 5 months from the side of the udder into which the injection was made.

Infection of the bovine udder with *Br. abortus* was first demonstrated by Schroeder and Cotton (5) in 1911, and has since been confirmed by numerous workers. A review of the literature reveals little information of the relative frequency of natural infection in the various quarters of the bovine udder, the bacteriological investigations apparently having been carried out on samples representing mixed milk from the four quarters or from any individual quarter. Topley and Wilson (6), in outlining a method of examining milk for *Br. abortus*, state that, since the organism may be excreted from one quarter only, the sample from a particular cow should contain milk from all four quarters of the udder. They do not, however, advise examining the milk of each quarter separately. Robinson (7), 1919, found that the titre of the milk varied according to the quarter of the udder from which it was taken. The absence of agglutinins may not, however, be indicative of the absence of infection, as Sheather (8), 1923, showed that occasionally the milk serum contains no agglutinins even when *Br. abortus* is present in the milk. Mitchell (9), 1932, from observation based on serological and cultural tests, has found *Br. abortus* infection more frequently in certain quarters of the udder.

When investigating the probability of "healthy carriers", by bacteriologically examining samples of mixed milk of cows with no history of contagious abortion, but which reacted in low dilutions to the agglutination test, negative results were frequently obtained. Since repeated examination of mixed samples seldom revealed the organism the possibility was suggested that a slightly infected quarter might eliminate milk containing only a few organisms and that the dilution and germicidal factors might be responsible for the negative results. Experiments were therefore carried out in order to gain further information of the distribution of *Br. abortus* in the infected udder.

\*Presented at the Christmas meeting of the Laboratory Section, Canadian Public Health Association, Toronto, December, 1933.

## EXPERIMENTAL

The findings reported in this communication refer to isolations of *Br. abortus* from the individual quarters of two groups of cows. One group consisted of five cows which, in spite of a negative clinical history of contagious abortion, had agglutinins for *Br. abortus* (strain 6730) in their blood serum in dilutions of 1:80 to 1:500. These were cows picked from a single herd and were all "high producing" animals; they have been classified as "healthy carriers" (10). The other group consisted of ten cows having a clinical history of, and which were reactors to the official test for, contagious abortion. They were animals picked from various herds in Quebec and Ontario.

The milk from individual quarters of the "healthy carriers" was examined at thirty-day intervals throughout one entire lactation period, and that of the clinically infected group was examined only once.

*Collection of Milk Samples*

Separate samples were collected from each quarter of the udder, all reasonable precautions being taken to prevent extraneous contamination. The udder was washed first with clean water and then with a solution of fifty per cent alcohol. The hands of the milker were also washed with alcohol just previous to the collection of each sample. The sample was collected in a sterile 200 c.c. Erlenmeyer flask, which was quickly stoppered and immediately placed in an insulated ice chest. When the samples from each quarter of one cow were collected, they were taken to the laboratory, transferred to special 100 c.c. Kohlrausch flasks and placed in a refrigerator to allow the cream to separate by gravity.

*Medium Employed*

Liver-infusion-gentian-violet agar similar to that used by Huddleson (11) was used. The method of preparation was modified slightly by passing the agar and liver infusion, before the addition of gentian violet, through a high speed clarifier in order to give a more transparent medium.

*Plating Method*

Petri-plates containing liver-infusion-gentian-violet agar were inoculated on the surface with 1/10 c.c. of gravity cream by the method described by the author (12). It was found advisable to pour the agar at least twelve hours previous to the inoculation, to allow the condensation water to evaporate or to be absorbed and therefore prevent the subsequent running together of the colonies. Plates were inoculated in duplicate.

*Incubation*

One set of plates was placed under bell jar and incubated at 37° C. for 5 days before examining. The other set was incubated aerobically for fifteen hours and then placed in special jars in which 10 per cent of the air was replaced with carbon dioxide. Incubation was continued for 5 days before examining.

*Identification of the Organism*

A colony suspected of being *Br. abortus* was inoculated in duplicate to liver-infusion agar slopes, one tube being incubated aerobically and the other incubated in a carbon-dioxide-rich atmosphere for five days, after which a stained film was made according to Hucker's modification of the Gram method. Each culture considered to be *Br. abortus* after microscopical and cultural tests was then tested serologically to insure correct diagnosis.

Table I shows the distribution of *Br. abortus* in the various quarters of the udders of the cows classified as "healthy carriers". It also shows that *Br. abortus* may localize in one quarter of the udder and may be persistently

TABLE I  
DISTRIBUTION OF *Br. abortus* IN THE INFECTED UDDER

Cow No.	Agglutination Titre	Stage of Lactation (Month)											
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
1	1:320	+	+	-	-	+	+	+	+	+	+	+	+
		RH	RH	M(RH)	M(RH)	RH	RH	RH	RH	RH	RH	RH	RH
		LH		(RF)									LF
													LH
2	1:200	-	+	+	+	-	-	-	-	-	-	-	-
			RH	RH	RH	M(RH)							
3	1:500	+	+	+	+	+	+	-	-	+	Dry	Dry	Dry
		RH	RH	RH	RH	RH	M(RH)			RH			
4	1:500	+	+	+	+	-	-	+	+	+	+	Dry	Dry
		RF	RF	RF	RF	M(RF)	M(RF)	(RF)	RF	RF	RF		
								M(RH)					
5	*1:80	-	-	-	-	-	+	-	-	Dry	Dry	Dry	Dry
		M(RF)	M(RF)				RF	M(RF)	M(RF)				

\*RH Quarter dry.

Code: RF = Right front quarter.  
RH = Right hind quarter.  
LF = Left front quarter.  
LH = Left hind quarter.  
M = Mastitis.  
+ = *Br. abortus* present.  
- = Neg.

excreted throughout the entire lactation period, provided that mastitis does not intervene. Repeated bacteriological examination of the milk from quarters showing clinical symptoms of mastitis always revealed long chain streptococci. There was no indication that the mastitis was caused directly by *Br. abortus*. It was never possible, by the methods outlined, to detect *Br. abortus* in milk showing a clinical and bacteriological picture of mastitis. Milk from quarters of the udder which had constantly been discharging *Br. abortus* for months no longer revealed the organism after mastitis appeared; *Br. abortus* could not again be isolated from such quarters for a period of 15 to 20 days, and sometimes not at all, after the clinical symptoms of the inflammation had disappeared. The reason for this is not at present clear. Cow No. 1 showed infection in the milk of both hind quarters at freshening, and in both hind quarters and the left front quarter at the end of lactation.

The first sample was taken twenty-four hours after parturition and the last sample at the extreme end of lactation. It would appear that the resistance of the individual quarters is weakened at these periods. In comparing the frequency of infection in definite quarters it appears that infection in the right hind quarter predominates. Infection appears to be equally persistent regardless of the quarter infected.

Table II shows the distribution of *Br. abortus* in cows showing clinical symptoms of contagious abortion. The results outlined show that infection

TABLE II

THE QUARTER DISTRIBUTION OF *Br. abortus* IN 10 COWS SHOWING CLINICAL SYMPTOMS OF INFECTIOUS ABORTION

Cow	Time interval between abortion date and date sample was collected. (Days)	Quarter of Udder			
		RF	RH	LF	LH
6	×	—	+	—	+
7	×	+	+	—	—
8	60	—	+	—	—
9	2	—	+	+	—
10	×	—	+	—	—
11	30 (app.)	—	+	—	+
12	16	+	+	+	+
13	62	—	+	—	—
14	20	+	Dry	—	0
15	28	—	+	—	+

Note: No mastitis was evident in this group at the time samples were collected.

Code: × = information not available.

— = positive.

— = negative.

0 = no test.

with *Br. abortus* is more frequent in the right hind quarter of cows which have recently aborted. Not considering cow No. 14 (R.H. quarter non-lactating), all the members of this group excreted the organism with the milk of the right hind quarter whether or not other quarters were infected. Six of these nine cows showed infection in at least one other quarter, while the remaining three showed infection in only the right hind quarter.

In correlating tables I and II, disregarding cows 5 and 14, it may be seen that out of thirteen cows, twelve excreted *Br. abortus* from the right hind quarter. One of these, cow no. 12, excreted the organism with the milk of all quarters. There is reason to believe that the right hind quarters of cows nos. 5 and 14 were rendered inactive through mastitis and, since there seems

to be a relationship between *Brucella* infection of the udder and mastitis which may later develop in such infected quarters, one is led to believe that the right hind quarters of these two cows were at one time infected with *Br. abortus*.

While the author realizes that the number of animals used in the experiment is small, yet the recorded results demonstrate, firstly, the specialized localization, and secondly, the persistency of excretion of *Br. abortus* over the entire lactation period. The specialized localization is of interest to the pathologist, but the significance of such information is paramount when examining the milk of individual cows bacteriologically for the detection of *Br. abortus*.

#### SUMMARY

In examining milk for the detection of *Br. abortus*, the milk from each quarter of the udder should be examined separately.

*Br. abortus* is continuously excreted with the milk from infected quarters, except when other infections intervene.

There is a tendency for *Br. abortus* to localize in the right-hind quarter of the udder.

*Br. abortus* is absent when clinical symptoms of mastitis are present in a quarter.

#### REFERENCES

- (1) Horrocks, Rep. Com. Medit. Fever, Part III, p. 84, 1905.
- (2) Zammitt, Rep. Com. Medit. Fever, Part III, p. 84, 1905.
- (3) Horrocks and Kennedy, Rep. Com. Medit. Fever, Part IV, p. 37, 1916.
- (4) Zwick and Krage, J. Comp. Path. & Therap., 26: 59, 1913.
- (5) Schroeder and Cotton, Rep. Bur. An. Ind., p. 139, 1911.
- (6) Topley and Wilson, Text, The Principles of Bacteriology and Immunity, Vol. II, p. 121; Wm. Wood & Co., New York.
- (7) Robinson, J. Comp. Path. & Therap., 32: 293, 1919.
- (8) Sheather, J. Comp. Path. & Therap., 36: 255, 1923.
- (9) Mitchell, Health of Animals Branch, Hull, Quebec, 1932.
- (10) Thompson, J. Infect. Dis. In the Press.
- (11) Huddleson, Hasley and Torrey, J. Infect. Dis., 40: 352, 1927.
- (12) Thompson, J. Bact., 26: 539, 1933.

# The Organization of a Medical Service Within a Sanatorium\*

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AND

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THIS communication records the development within a tuberculosis sanatorium of a distinct division for the study and treatment of various medical conditions, other than tuberculosis, from which the tuberculous patient may suffer; the practical value of such a scheme of organization is also indicated.

In the sanatorium surgical problems and those involving the ear, nose and throat should be the concern of a definite department of surgery and otolaryngology, respectively. A definite trend for such specialization and segregation of the laboratory field is shown by the tendency to provide endowed departments for this work in various institutions. As accurate diagnosis of disease is the fundamental basis of all scientific advance in medicine or surgery, we believe that a special department of medicine is even more essential.

As the cases for which we advise group study are relatively few in number, they cannot be studied to best advantage in different wards, by different people; but, when segregated, they present a wonderful opportunity within the sanatorium for intensive study. Our patients are hospitalized for long periods of time and may be followed at clinics for years after their discharge. This fact, when considered in the light of the scope of medical work within the sanatorium, gives an opportunity for each institution with a medical division to take an active part in the solution of the present day problems of chronic diseases, as well as rendering a definite contribution to the total work of the institution.

It is far more difficult to establish a medical service than either a laboratory or surgical service, as the history of all sanatorium organization for the past five years has shown. But, in enlisting lay support and interest in our organization, one well known fact has been constantly kept in mind, namely, that, although the intelligent layman is most easily impressed by the obviously sincere and logical appeal of the surgeon or laboratory worker, yet when the same man becomes ill with a condition not obviously requiring surgical aid, he goes first to an internist.

The first requisite in the organization of a medical service is the adoption as routine for all admissions of a full history and examination record of the

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\*From the infirmary for the study of medical conditions associated with pulmonary tuberculosis, Mountain Sanatorium.

type used in all good general hospitals. Four years ago full records were adopted as routine in the medical infirmary and are now used for the institution as a whole.

The medical service should have supervision of the admitting ward from which selection is made of cases suitable for further study in the medical division. Probably the first cases to be specifically considered would be those cases requiring special dietary management. Cases of intestinal tuberculosis, who require some form of soft or light diet, can be most efficiently treated in one building or ward. We have followed this practice in our institution in the past three years and the good results observed leave no doubt of its value. In the simpler cases, where the diagnosis of intestinal tuberculosis is based mainly on gastro-intestinal X-ray study, the problem is not great. For the majority of such cases the ordinary routine of diet and therapy made standard for the special ward will suffice. On the other hand, the more serious cases, where there is pain, anorexia, nausea and diarrhoea, require individual management. When such patients realize that they are being studied both individually and in a group manner, and that the nurses in attendance have been taught to appreciate their problems, then and not before do their complaints become simple statements of fact rather than, in many cases, the continual protest of individuals puzzled and worried over their anorexia, loss of weight, pain, etc. Such segregation of at least the more puzzling abdominal cases should certainly be part of a triad of surgical, medical and X-ray services which should complete the work of clinical investigation.

There are, too, those patients who may usually be classed under the term "chronic abdomen" and who may have in addition tuberculous enteritis. We have four such cases. Of the four, two had chronic cholecystitis, one adhesions, and the fourth, although having extensive tuberculous involvement of the gut, had a tuberculous appendix removed with definite relief of intestinal symptoms. There are in addition two cases of duodenal ulcer and other other case of frank cholecystitis.

Among 100 patients in the medical infirmary, we have 16 such cases of intestinal tuberculosis, three cases of chronic cholecystitis, two cases of duodenal ulcer. Included in this summary are the few patients in whom the problem was one of "chronic abdomen".

So far the discussion has dealt with medical problems that are closely related to dietetic management within the medical service. An essential part of a proper medical service is, therefore, a diet kitchen, where the special trays are supervised. In our own gradual organization of a medical service we have seen certain errors creep into the use of the dietitian's services. In an insidious and hardly explicable way we found the list of substitutes given out increasing beyond reason. Where each of four physicians had perhaps one case for special diet, the work of the dietitian, on account of difference in diets ordered for the same condition, was much more difficult than when one physician had supervision over twice the number of cases.

By placing the diet cases in the medical infirmary we have accomplished

more than we had even hoped. Not only were the cases requiring special diet cared for more intensively and efficiently, but far less confusion resulted. The dietary management of the rest of the patients in the infirmary became much easier. The list of substitutes decreased to zero point and there were far fewer complaints regarding the general diet. One can only presume that the patients all reacted favorably to the recognition of the principle that a special diet was for those who needed it.

The next group of cases eligible for inclusion in a medical service consists of those few patients who exist in every sanatorium and are best described as border-line cases. They may possibly be mild diabetics, mild hyperthyroids, or cases of actual hypothyroidism. Perhaps there may be a case showing albuminuria without any obvious cause ascertained by the ordinary procedures of investigation. While the scope of this paper does not include a discussion of renal diabetes or orthostatic albuminuria, and like cases that come readily to mind, we maintain that such cases, few in number as they usually are, should be studied under a medical service. We have three or four such cases being studied at present.

We have purposely left to the last the discussion of a special group of patients eligible for the medical service. We refer to patients who have in addition to tuberculosis some condition such as diabetes mellitus, chronic nephritis, hypertension, syphilis, pernicious anaemia, and Addison's disease. We have cases of all these diseases in this list of 100 patients. There at present one case each of pernicious anaemia, Addison's diseases, and chronic nephritis, two cases of hypertension, and ten cases of diabetes mellitus. In the past two years seven syphilitics have been under active treatment.

We cannot miss the opportunity here of pointing out that it was the existence of these cases that for perhaps one to two years hampered the development of a medical service. So interesting to everyone are these people that often they were receiving more than their fair share of attention, while others probably failed to be investigated. One had to keep persistently in mind that any medical service in a sanatorium loses most of its effectiveness within the institution if it allows itself to study only the few cases of diabetes, syphilis, etc., that come its way. A definite medical service ensures that all medical problems will be thoroughly investigated.

In our infirmary we have developed, in the past three years, a working plan for routine treatment of tuberculous syphilitics. Kidney function tests have been given intensive study and observations are being made of gradual changes in the heart indicating onset or increase of pulmonary circulation hypertension. This work is not yet complete, but so far it has at least supplied standards of normal and abnormal for the whole institution. All such studies stimulate interest and help each member of the staff. The dispersal of the few diabetics and syphilitics, etc., available in one province or district to several sanatoria has been the main reason why so little study of these patients has been made by sanatoria.

After organization of such a medical service, if it is to be routinely

accepted and used efficiently there must be co-operation between the various services within the sanatorium. A laboratory service frequently suffers confusion when every member of the staff requests different laboratory procedures to be carried out on cases such as have been mentioned under the term borderline cases. Granted that the management of the individual case must always be the problem of the clinician, yet the segregated, intensive study of these cases will undoubtedly result in more consistent and intelligent use of laboratory facilities as they apply to these special cases. This is one example only of how the medical service helps to make co-operation a very real thing.

For the past two years our sanatorium has been affiliated with a general hospital. By this connection the physician in charge of the medical infirmary has for periods of three months the assistance of senior internes in medicine, who thus spend in rotation three months of their general hospital year in the medical infirmary. The interne, in addition to amplifying his knowledge of chest work, has time to study in an intensive way, for a reasonable time, a selected group of patients, to his own definite advantage.

The advantages to the sanatorium and to the sanatorium staff are quite as obvious, for such a specialized study of a group, with the free discussion of results, means that instead of any physician on the staff feeling that he is losing by the transference of one or two cases to the medical service, he will realize in a short time that the little he loses by transferring his few cases will be more than compensated for by the much greater knowledge obtained from the results of intensive work done on a fairly large series. In other words, for each institution a common language and understanding will develop among the staff regarding medical problems.

Only when a medical service is made distinct in a sanatorium can the services of the consultant in medicine to the sanatorium be made really effective.

### SUMMARY

We believe that a distinct medical service should be established in each large sanatorium.

The primary object of such a service is the management of the medical problem cases that often may be neglected because their care is no one person's responsibility.

No service within a sanatorium can so routinely bring into contact so many different departments or members of the staff.

The medical service should be able to initiate certain general investigations applicable to the whole institution.

# EDITORIAL SECTION

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## DEFINING OBJECTIVES

IT may be said fairly to-day that the most urgent need in every field of public health endeavour is to define clearly the objective to which the work is directed. How much would be gained if the objective was clearly defined before any public health activity was undertaken! The plan to be followed would be seen in its broad outline and its weaknesses and limitations would be recognized at the commencement instead of at a late and unfortunate date. How much of our present activity in a department of health would be revealed as so much work faithfully performed but contributing little to the specific objective of the endeavour?

To evidence the need of defining our objectives one might refer to one of the least effective tasks of the medical officer of health, but one which, if the objective were defined, would be seen in a new light; namely, the annual report. To the majority of health officers the annual report represents simply an accounting of the department to the local board of health which is required to be submitted. Such a report is usually a compilation of the vital statistics, with the inclusion of more or less detailed reports of the sanitary inspector, the public health nurse, and other members associated with the department.

What is the purpose of the report? What are its objectives? Without question the first purpose should be to outline what has been accomplished during the year. Of equal or greater importance is the directing of attention to urgent health work which needs to be done and the presentation of the major health problems so that the citizens may know the facts and have an understanding of the important health problems of the community. A third purpose of the report is to show how the money appropriated has been expended in advancing the health of the community.

It is the responsibility of the health officer to lay before the people, in a clear, simple manner, the true picture of the health conditions of the community and to inform them of what needs to be done to safeguard their health during the coming years. The annual report affords this opportunity. Instead of being an uninteresting and unproductive tabulation, it may become one of the major avenues for

interesting the public in the work of the department. Defining its objectives reveals its possibilities. And so, too, in tuberculosis control, in school health service and in the whole field of child hygiene, the time spent in analysing the purposes of the work will be richly repaid.

### CROSS-CONNECTION DANGERS IN WATER SUPPLIES

**A**LTHOUGH general legislation has been in effect on this continent, ample evidence supports the contention that dangerous cross-connections do exist in many industrial plants, hotels and other buildings, and that a large part of the reported cases of typhoid in cities is due to the pollution of water supplies through cross-connections.

The importance of this danger is emphasized in the report of the special committee investigating the outbreak of amoebic dysentery in Chicago. It would appear that the outbreak in the two hotels in which the largest number of cases occurred originated as the result of the contamination of the water supply of the hotels with sewage. Investigation showed the extent of the defective water and sewerage piping layouts. The infection of the water supply resulted in widespread infection of food handlers and others employed in the hotels. Among the 364 food handlers examined in the first survey in Chicago, 15 carriers of *Endamoeba histolytica* were found. Subsequent examination of the personnel of the same hotels showed the infection of 118 additional employees. By the end of January 721 clinical cases in 206 cities, including Chicago, had been reported as apparently originating from this source, according to the investigation by the Surgeon General. Fourteen deaths were reported in Chicago from this outbreak. Estimates of the percentage of the population harbouring *Endamoeba histolytica* in the United States indicate that possibly 4 per cent harbour this organism. Although transmission is usually by food handlers, this investigation of the Chicago outbreak indicates the part played by polluted water. Further evidence of the danger of polluted water is contained in the report of the Chicago outbreak by Bundesen, Tonney and Rawlings. In an industrial plant employing approximately 375 workers, cross-connections permitting raw river water to contaminate the water supply in the plant accounted for an outbreak of diarrhoea in December. Investigation revealed 7 cases of amoebic dysentery, 71 carriers, and 3 cases of typhoid fever following this contamination by raw river water.

The Public Health Acts of the various provinces apply in a general way to cross-connections and Ontario and Quebec are to be commended for the special regulations which have been enacted. The danger of such connections, however, calls for the prompt establishment of an adequate system of inspection and the enforcement of strict regulations in every province in which such dangers may exist. It is not sufficient to deliver a properly treated or safe water into the distribution mains of a municipality. Protection must include the safeguarding of the supply at every step from its source to the consumer.

## Montreal and the Twenty-Third Annual Meeting

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To the Members of the Association :

**I**T IS with the greatest pleasure that I extend to you a most cordial welcome to our old province of Quebec, the cradle of Canada and, I may add, the cradle of hygiene in this country for, we must not forget, from the very beginnings of the colonization of "La Nouvelle France" the public health has been accepted as a responsibility by the government of the period.

Many of you, no doubt, will find the city of Montreal a novel environment, for two-thirds of its population are "French subjects of His Britannic Majesty"; but you will observe that, although very proud of the French culture handed down to him by his ancestors, the French-Canadian is quite able to appreciate the English culture about him. Needless to say, we shall be very happy to have you with us.

The gathering together of health administrators of the whole country and of those who, in whatever capacity, are interested in hygiene, is an event of major importance in a critical period such as that through which we are passing. It is true that the statisticians have not thus far detected an increase in the general mortality, but it is nevertheless to be expected that the continued privations to which our people are subjected, the lack of proper food, the overcrowding of dwellings, the injurious habits engendered by idleness or discouragement, the great mental anguish, etcetera, will have their repercussion on the health of the sufferers.

As a consequence, the professional hygienists and other friends and missionaries of hygiene must close their ranks the better to face the situations which are sure to develop and which will certainly demand further effort from us all.

The papers to be presented at the meeting are varied and, I am sure, will interest you. They will enable you to compare both the methods followed in the different provinces and the results obtained. Thus, through these papers and the discussions and comments which they must provoke, we shall benefit from the experience of others. Therein lies the great utility of these scientific meetings: they consolidate the knowledge acquired and orient future effort.

Come all and help us to make the convention of 1934 a success.



DR. ALPHONSE LESSARD

*Alphonse Lessard*

President

# Programme

## TWENTY-THIRD ANNUAL MEETING

### CANADIAN PUBLIC HEALTH ASSOCIATION

in conjunction with the annual meeting of the

### CANADIAN TUBERCULOSIS ASSOCIATION

Montreal, Quebec, June 11-13, 1934

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#### CONVENTION HEADQUARTERS: THE WINDSOR HOTEL

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#### DIRECTORY OF SESSIONS

##### Monday, June 11th

- 9.00 a.m. Registration.
- 9.30 a.m. Section Meetings:
  - Industrial Hygiene.
  - Vital Statistics.
- 2.30 p.m. General Session.
- 8.00 p.m. Meeting of the Executive Council.

##### Tuesday, June 12th

- 9.30 a.m. Section Meetings:
  - Laboratory.
  - Public Health Engineering.
  - Public Health Nursing.
  - Vital Statistics.
- 2.30 p.m. Field Visits.
  - Session, Canadian Tuberculosis Association.
- 7.15 p.m. Dinner Session.

##### Wednesday, June 13th

- 9.30 a.m. Section Meetings:
  - Laboratory and Engineering (combined session).
  - Nursing and Mental Hygiene (combined session).
  - Vital Statistics.
  - Session, Canadian Tuberculosis Association.
- 2.30 p.m. Joint Session with the Canadian Tuberculosis Association.

#### FIRST SESSION

##### Industrial Hygiene Section

##### Monday, June 11th, 9.30 a.m.

- Chairman—Dr. R. Vance Ward, Department of Public Health and Preventive Medicine, McGill University, Montreal.
1. Municipal Organization for Industrial Hygiene—Dr. F. G. Pedley, Department of Public Health and Preventive Medicine, McGill University.
  2. Experimental Study of Poisoning from Mercury Vapour—Dr. K. I. Melville, Dr. A. M. Fraser and Dr. R. L. Stehle, Montreal.
  3. Evaluation of Industrial Health Hazards—Dr. F. M. R. Bulmer, Division of Industrial Hygiene, Ontario Department of Health, Toronto.
  4. Problems of Railway Sanitation—Mr. Eric R. White, Chief Sanitary Inspector, Canadian National Railways, Montreal.

*Election of Officers.*

### **Vital Statistics Section**

**Monday, June 11th, 9.30 a.m.**

1. Chairman's Address—Dr. Eugene Gagnon, Superintendent, Division of Vital Statistics, Department of Health, City of Montreal.
2. Report of the Committee on Non-Resident Births and Deaths—Mr. T. E. Ashton, Statistician, Division of Vital Statistics, Department of Health, City of Toronto.
3. Report of the Committee on the Form of the Medical Officer's Report—Dr. D. V. Currey, Medical Officer of Health, St. Catharines, Ontario.
4. Supplementary Questionnaires in Use in the Province of Saskatchewan—Mr. Stuart Muirhead, Director, Division of Vital Statistics, Saskatchewan Department of Health, Regina.
5. Some Statistical Indications about the Mortality of the Pre-school Child—Miss Agnes B. Baird, Reg. N., Secretary, Division of Maternal and Child Welfare, Canadian Council on Child and Family Welfare, Ottawa.

### **SECOND SESSION**

#### **General Meeting of the Association**

**Monday, June 11th, 2.15 p.m.**

1. Addresses of Welcome—His Worship, Mayor Houde.  
Dr. S. Boucher, Medical Officer of Health, Montreal.
2. Presidential Address—Dr. Alphonse Lessard, Director, Provincial Bureau of Health, Quebec.
3. The Relationship of Public Health to Medical Care—Dr. A. Grant Fleming, Department of Public Health and Preventive Medicine, McGill University, Montreal.
4. The Next Step in a Generalized Programme of Public Health Nursing—Dr. W. J. Bell, Deputy Minister of Health for Ontario, Toronto.
5. Amoebic Dysentery: Its Public Health Significance and Control—Dr. A. Bolduc, Superintendent of Laboratories, Department of Health, Montreal.

### **THIRD SESSION**

#### **Laboratory Section**

**Tuesday, June 12th, 9.30 a.m.**

1. Cultural Methods of Isolation of Tubercle Bacilli—Dr. A. L. McNabb and Dr. Wallace MacClure, Division of Laboratories, Ontario Department of Health, Toronto.
2. La teneur en colibacilles, mesure de l'efficacité de la pasteurization—M. Jacques Archambault, Chimiste-en-charge, Bureau Provincial d'Hygiène de la Province de Québec.
3. Anti-Abortus Serum—Dr. Chas. A. Mitchell, Animal Diseases Research Institute, Hull, Quebec.
4. Results in Immunization, using Various Time Intervals in Administration of Diphtheria Toxoid—Dr. E. A. Clarke, Hospitals Division, Ontario Department of Health, Toronto.
5. (a) Further Experience with the Combined Dark Field Outfit in the Diagnosis of Syphilis.  
(b) Comparison of Kahn Precipitation and Kolmer Complement Fixation Reaction Test as Diagnostic Agents in the Diagnosis of Syphilis—Dr. McNabb and Dr. MacClure.
6. Dried Complement for Use in the Wasserman Test—Dr. James Craigie, School of Hygiene and Connaught Laboratories, University of Toronto, and Dr. McNabb.
7. The Value of Kocto Vaccines—Dr. F. Smith, Department of Bacteriology, McGill University, Montreal.
8. Organisms of the Bacteriodes Group found in Lochia—Dr. Theodore E. Roy, Department of Bacteriology, McGill University, Montreal.
9. Acute Lymphatic Leukaemia—Dr. Bruce Chown, Children's Hospital, Winnipeg.

#### **Public Health Engineering Section**

**Tuesday, June 12th, 9.30 a.m.**

- Chairman—Mr. T. J. Lafrenière, Provincial Bureau of Health, Montreal.
1. Sewer Explosions—Mr. Frank Dowd, Technical Service, Department of Health, City of Montreal.
  2. Housing in Montreal—Mr. A. L. Cousineau, Sanitary Engineer, Department of Health, Montreal.
  3. Cross-Connections in Water Supplies—Mr. René Cyr, Assistant Sanitary Engineer, Provincial Bureau of Health, Montreal.
  4. The Present Status of Water Supplies on Common Carriers—Mr. G. H. Ferguson, Chief Engineer, Department of Pensions and National Health, Ottawa.

### Public Health Nursing Section

**Tuesday, June 12th, 9.30 a.m.**

1. Chairman's Remarks—Miss Elizabeth Smellie, Reg. N., Victorian Order of Nurses, Ottawa.
2. The Development of Community Responsibility in Health Activities—Dr. J. E. Sylvestre, Inspector of County Health Units, Provincial Bureau of Health, Quebec.
3. The Educational Objective of Public Health Nursing—Miss Marion Lindeburgh, B.Sc., Reg. N., Assistant Director, School for Graduate Nurses, McGill University, Montreal.
4. The Development of Teaching Ability in the Nurse—Miss Alexina Marchessault, P.H.N., Directrice, School for Public Health Nursing, University of Montreal.
5. Application of Teaching Principles through:
  - (a) County Health Unit Programme—Miss Dorothy Gorman, Reg.N., Provincial Bureau of Health, Quebec.
  - (b) Visiting Nurse Programme—Miss Beatrice Brookes, B.A., Reg. N., Victorian Order of Nurses, Montreal.
  - (c) The Use of Records—Miss Rosanne Lalande, Reg. N., Metropolitan Life Insurance Company, Montreal.
6. Community Relationship:
  - (a) Rural—Miss N. Edna Howey, Reg. N., Ontario Department of Health, Toronto.
  - (b) Urban—Miss Mary S. Mathewson, Reg. N., Child Welfare Association, Montreal.

Discussion—Led by Miss M. E. Nash, Reg. N., Victorian Order of Nurses, Montreal, and Miss Maria Roy, Reg. N., Department of Health, City of Montreal.

*Election of Officers.*

1.30 p.m. Section Luncheon.

### Vital Statistics Section

**Tuesday, June 12th, 9.30 a.m.**

Chairman—Dr. E. Gagnon, Superintendent, Division of Vital Statistics, Department of Health, City of Montreal.

1. Title to be announced—Dr. Paul Parrot, Statistician, Provincial Bureau of Health, Quebec.
2. The Form of the Medical Certificate of Death:
  - (a) Report of the Committee—Presented by Dr. R. D. Defries (chairman) and Dr. A. H. Sellers (secretary), School of Hygiene, University of Toronto.
  - (b) Round-table Discussion—To be opened by Mr. E. S. Macphail, Chief, Division of Census and Vital Statistics, Dominion Bureau of Statistics, Ottawa.

### FOURTH SESSION

#### General Meeting of the Association

**Tuesday, June 12th, 2.30 p.m.**

Programme of field visits, arranged through the courtesy of the Department of Health, City of Montreal, and the Provincial Bureau of Health.

### FIFTH SESSION

#### Dinner Meeting

**Tuesday, June 12th, 7.15 p.m.**

Speaker—The Honourable L. A. David, K.C., Provincial Secretary, Quebec, and Honorary President, Canadian Public Health Association.

Greetings from the American Public Health Association will be conveyed by Dr. Haven Emerson, President, and by Dr. John A. Ferrell, of the International Health Division, Rockefeller Foundation.

## SIXTH SESSION

### Combined Sections of Public Health Engineering and Laboratory

**Wednesday, June 13th, 9.30 a.m.**

Chairman—Mr. T. J. Lafrenière, Provincial Bureau of Health, Montreal.

1. A Typhoid Fever Epidemic from Cheese—Dr. A. R. Foley, Epidemiologist, Provincial Bureau of Health, Quebec.
2. A Typhoid Fever Epidemic from Water and Milk—Mr. E. Langevin, Division of Sanitary Engineering, Provincial Bureau of Health, Quebec.
3. Control of Milk Supply for a Small Town—Mr. MacHarvey McCrady, Chief of Laboratories, Provincial Bureau of Health, Montreal.
4. Food Inspection—Dr. J. Hood, Food Inspector, Department of Health, City of Montreal.

### Combined Sections of Public Health Nursing and Mental Hygiene

**Wednesday, June 13th, 9.30 a.m.**

Chairman—Dr. B. T. McGhie, Deputy Minister of Hospitals, Ontario Department of Health, Toronto.

1. Emotional Expression and Control—Mrs. Harriet Mitchell, Educational Secretary, Mental Hygiene Institute, Montreal.  
Discussion—Dr. G. N. Paterson-Smyth and Miss Blanche Bourbonnais, Montreal.
2. A Provincial Mental Health Programme—Dr. E. A. Clarke, Hospitals Division, Ontario Department of Health.  
Discussion—Dr. J. E. A. Marcotte, Montreal.

## Vital Statistics Section

**Wednesday, June 13th, 9.30 a.m.**

Chairman—Dr. E. Gagnon, Superintendent, Division of Vital Statistics, Department of Health, City of Montreal.

1. Notre Bilan-Vie—Dr. J. A. Baudouin, professeur d'Hygiène et directeur de l'Ecole d'Hygiène sociale appliquée de l'Université de Montréal.
2. Title to be announced—Mr. A. J. Pelletier, Assistant Chief, Division of Demography, Dominion Bureau of Statistics, Ottawa.

Typhoid Fever Mortality in Ontario, 1880-1931—Miss Mary A. Ross, M.A., Department of Epidemiology and Biometrics, School of Hygiene, University of Toronto.

The Reporting of Infectious Diseases in Health Units in the Province of Quebec—Dr. A. R. Foley, Epidemiologist, Provincial Bureau of Health, Quebec.

Morbidity and Mortality in Industrial Establishments—Dr. R. Vance Ward, Department of Public Health and Preventive Medicine, McGill University, Montreal.

*Election of Officers.*

## SEVENTH SESSION

### Joint Meeting with the Canadian Tuberculosis Association

**Wednesday, June 13th, 2.15 p.m.**

1. A Scientific Basis for the Control of Tuberculosis in a Defined Area—Dr. C. G. Shaver, Superintendent, Niagara Peninsula Sanatorium, St. Catharines, Ontario.
2. Minimum Requirements for a Provincial Tuberculosis Programme—Dr. R. G. Ferguson, Director of Medical Services and General Superintendent, Saskatchewan Anti-Tuberculosis League, Fort San, Saskatchewan.
3. Some Observations on Maternal Mortality—Dr. J. T. Phair, Director, Division of Maternal and Child Hygiene, Ontario Department of Health, Toronto; and Dr. A. H. Sellers, Department of Epidemiology and Biometrics, School of Hygiene, University of Toronto.
4. Travelling Tuberculosis Clinics in the Province of Quebec—Dr. Auguste Leboeuf, Provincial Department of Health, Quebec.
5. Duties and Responsibilities of a Health Units' Inspector—Dr. Jean Gregoire, Provincial Bureau of Health, Quebec.

*Reports of the Committees on Resolutions and Nominations.*

**Ontario Conference**  
**Royal York Hotel, Toronto**  
**May 28 - June 1, 1934**

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**S**TRIKING evidence of the interrelationship of the practice of medicine with the practice of preventive medicine and public health is afforded by the programme for the week of medical meetings in Toronto commencing May 28th which is designated as the Ontario Conference of members of the Ontario Health Officers' Association with other representatives of the Canadian Public Health Association and members of the Ontario Medical Association. The programme of meetings extends from Monday morning until Friday afternoon and features of the week include an important session of the Ontario Health Officers' Association on Monday afternoon, with dinner in the evening followed by a general discussion of several important health problems; the holding of the round-table conference of the Ontario Medical Association, which has become such an important session of the Association, on Tuesday evening; and the annual dinner of the same organization on Wednesday evening. A series of exhibits, including contributions from the Provincial Department of Health, will be shown in the banquet hall during the conference.

On Monday afternoon Dr. J. J. McCann, president of the Ontario Health

Officers' Association, will contribute an important paper constituting his presidential address. The Honourable Dr. J. M. Robb, Minister of Health and Labour, will speak on objectives in public health work and no part of the programme will be more important than this message relating to actual accomplishments in the light of our objectives. Last year a round-table conference was arranged to provide an opportunity for a frank discussion of problems of general interest to health officers throughout the province. This year the Association will meet for dinner on Monday and the evening will be devoted to a general discussion of a number of interesting subjects, including the cost of health services, the health demonstration in the eastern counties, the quarantine period for scarlet fever, and methods for ensuring that only eligible persons receive free treatment and



**DR. J. J. McCANN**  
**Medical Officer of Health, Renfrew**  
**PRESIDENT**  
**[Ontario Health Officers' Association]**

## *Ontario Health Officers' Association*

### *Canadian Public Health Association*

### *Ontario Medical Association*

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health services and that those who are eligible do receive such treatment.

An innovation will be the providing on Tuesday morning of six demonstrations in the fields of sanitary engineering, industrial hygiene, laboratory services, dental services, and preventable diseases with special reference to tuberculosis. The directors of the various divisions of the Provincial Department of Health are providing the demonstrations in their respective fields. Each demonstration will occupy forty minutes and will be arranged in a separate room, with special exhibits. Those attending will be requested to choose three of the demonstrations. An example of the interesting demonstration programme is that provided by the Division of Preventable Diseases, which will consist of the administration and the interpretation of the Dick and

Schick tests, vaccination and other procedures of specific immunization. On Tuesday afternoon Mr. H. H. Wolfenden, consulting actuary, will speak on "Insurance in Public Health". At the same session Dr. H. K. Box, honorary consultant in dental services to the Ontario Department of Health, will discuss the subject of trench mouth as a public health problem of major importance. Three other papers of special interest will be presented at this session by Dr. A. E. Berry, Dr. A. L. McKay and Dr. A. L. McNabb, and Dr. A. F. McKenzie.

Wednesday's sessions, both morning and afternoon, will be held in association with the Ontario Medical Association. In addition to a programme of general papers in the field of medicine and surgery, a programme of preventive medicine is being provided in the morning. At the general session on Wednesday afternoon the subject of maternal welfare in Ontario will be discussed. A garden party will close the afternoon session and in the evening the annual dinner of the Ontario Medical Association will be held. The programmes on Thursday and Friday will be provided by the Ontario Medical Association.



**DR. WARD WOOLNER**  
Medical Officer of Health, Ayr  
FIRST VICE-PRESIDENT  
Ontario Health Officers' Association

# EPIDEMIOLOGY AND VITAL STATISTICS

## *The Use of the Endemic Index in Presenting the Incidence of Communicable Diseases*

R. D. DEFRIES, M.D., D.P.H., and MARY A. ROSS, M.A.

*School of Hygiene,\* University of Toronto*

THROUGHOUT Canada physicians are required to report to the local medical officer of health cases of certain communicable diseases. It is important that the health officer should know not only the present incidence but its trend, and be able, if possible, to foresee an epidemic. In receiving reports, he is concerned primarily in knowing if such constitute an abnormally large number of any of the diseases. In small centres direct reference to the records of former years can be had quickly and comparison made with the corresponding period of the past year. It is realized, of course, that comparison with similar data for a term of years would afford a more reasonable basis, due to the wide fluctuations in incidence which may occur. In provincial and state departments of health and in the larger cities it has been found desirable to represent in one figure the previous experience of the same month for a period of years, usually from five to ten years. Such monthly or weekly figures are spoken of as the "estimated expectancy" or the "endemic index", presenting the probable mid-course of the incidence in the absence of epidemics.

Two methods are commonly employed in the determination of the endemic index. In one, the average incidence, the total number of cases for each month in each of the years for the period selected is taken and divided by the number of years. Thus the average incidence for the month of January for a period of ten years is obtained by dividing by ten the total

number of cases occurring during that period. In determining the median, the figures for the period of years are arranged in "array", namely, in order of magnitude. The median is defined as the mid point, the figure occupying this position being selected. An average of the three central figures in the array is often used, being spoken of as an adjusted median. In certain diseases extremely wide fluctuations may occur, as in influenza, and to estimate expectancy by using the average is obviously unsatisfactory. The determination of the median is to be preferred in influenza and in other diseases exhibiting wide fluctuations.

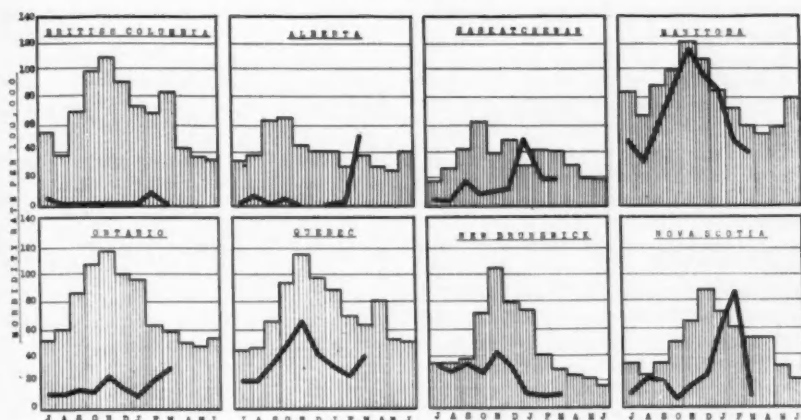
In selecting the period of years in determining the endemic index, consideration must be given to the trend of the incidence. In diphtheria, for instance, there has been a very marked fall in incidence in each of the provinces during the past five years. The calculation of the endemic index based on the experience of the past ten years would be considerably higher than if based on the past five years, due to the inclusion of the earlier years of higher incidence. The index calculated on this shorter period of five years would more truly represent the expectancy in this disease. A ten-year period, however, would probably give a fairer expectancy in whooping cough and measles, which are characterized by wide fluctuations in incidence.

Three fundamental forces influencing the movement of an epidemic disease are presented in a study of this subject by Hedrich; namely, the secu-

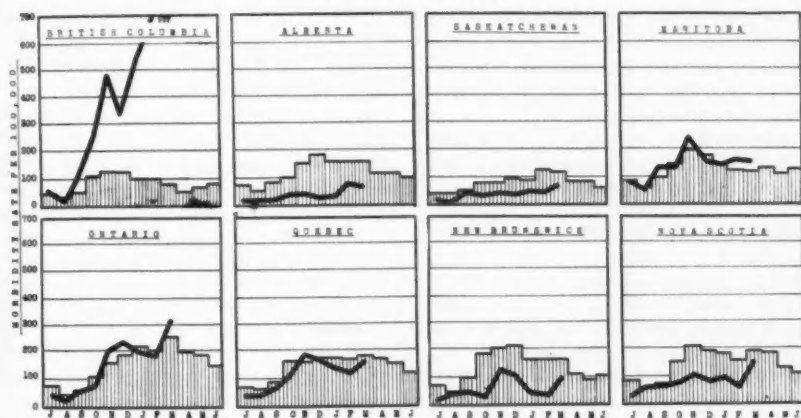
\*Department of Epidemiology and Biometrics.



DIPHTHERIA



SCARLET FEVER



WHOOPING COUGH

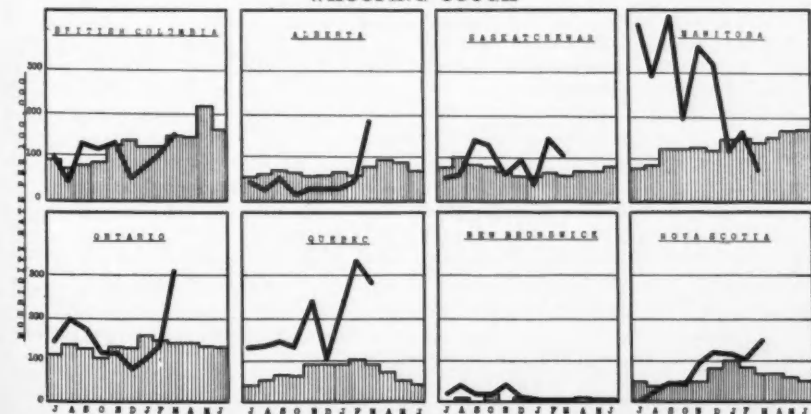


Figure II.—Monthly morbidity rates, July 1933-March 1934, for eight provinces of Canada, with the endemic index. The morbidity rate is represented by the black line and the endemic index as the shaded bars.

month period of July first of each year to June thirtieth of the following year, instead of using the calendar year. The incidence for each of the diseases for each province has been presented as mortality rates per 100,000 population, and not as the number of cases. From the study, the accompanying graphs have been selected which relate to the incidence of four epidemic diseases in eight provinces for nine months, namely, July, August, September, October, November and December of the year 1933 and January, February and March of 1934.

It is to be recognized, of course, that the proportion of cases reported in each of these diseases varies greatly in the different provinces. Any comparison of the incidence made, therefore, between different provinces from these data must be made only after due consideration of this fact. The data are admittedly very incomplete. Diphtheria and scarlet fever in each province are reported much more completely than are whooping cough and measles. Comparison, however, of the current incidence with the preceding experience in a province may be made, indicating, in a general way, whether the disease to which the data relate is above or below its average incidence. These facts should be borne in mind in interpreting the accompanying graphs.

*Diphtheria.*—As presented in Figure I, the incidence of diphtheria in British Columbia and Ontario was much below the average of the past five years (endemic index). In all the provinces the reported cases each month, with one or two exceptions, have fallen below the expected number.

*Scarlet Fever.*—In general, the monthly incidence of this disease has been below the average in five of the provinces, slightly above the average in Manitoba and Ontario, and markedly higher in British Columbia.

*Whooping Cough.*—With the exception of Alberta, the reported cases have exceeded the average number of cases for the past ten years. In several of the provinces the disease was epidemic. The completeness of reporting of whooping cough varies in different provinces. This fact must be remembered in making comparisons of incidence between provinces.

*Measles.*—The reference made to the incompleteness of reporting in whooping cough is equally applicable to the incidence of measles as presented in Figure II. In Saskatchewan and Manitoba measles was prevalent, in contrast to a low incidence in the remaining provinces.

With a weekly or monthly endemic index prepared for the major communicable diseases, the health officer is enabled to note the trend of the incidence and to judge the importance of an increase in the number of reported cases. It affords a convenient and valuable means of comparison of the present incidence with previous incidence.

#### REFERENCES

1. A. W. Hedrich, *The "Normal" for Epidemic Diseases*. Am. J. Pub. Health, 17: 691, 1927.
2. Hilda M. Woods, *Epidemiological Study of Scarlet Fever in England and Wales since 1900*. Med. Res. Coun. Spec. Rep. Series No. 180.

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# INDUSTRIAL HYGIENE

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## *Present-Day Knowledge of Ventilation\**

R. VANCE WARD, M.D., AND FRANK G. PEDLEY, B.A., M.D., D.P.H.

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IN the field of public health there is probably no science less clearly and thoroughly understood than that of adequate ventilation of the enclosed spaces in which we live and work. Although at least twenty years ago leading research workers in this science worked out and published the fundamental facts underlying good ventilation, although these fundamental principles are simple, reasonable and easily understood, we still find legislation on our statute books framed in the days of the older conceptions; we suffer in buildings adequately equipped for proper ventilation but distinctly uncomfortable because no one in charge takes the trouble to make this equipment produce the proper air conditions; and finally, we see men and women, educated ten to twenty years ago and charged with the duty of teaching children at the present time, passing on the older conceptions of ventilation at the expense of the newer, more thoroughly proven ones.

The science of ventilation is the science of the proper conditioning of the indoor air in which we live. Let us review briefly some of the chemical and physical properties of the air covering the earth and the changes which may, from time to time, occur in these properties.

Air is a mixture of the following gases in these proportions (approximate number of volumes per cent): oxygen 20.93, nitrogen 78.10, carbon dioxide 0.03, argon 0.94, and traces of helium, krypton, neon

ammonia, hydrogen peroxide and ozone.

With respiration or combustion going on, the oxygen is slightly diminished and the carbon dioxide is increased. The nitrogen and argon are, as far as we know, quite inert in their relationships to the human body.

From the physical standpoint, air has a definite pressure, varying slightly in the vicinity of 760 m.m. of mercury. These slight variations have no effect on the human body, and we encounter marked pressure variation with resultant symptoms only in aeronautics and mountaineering (decreased pressure), and in caisson work with artificially increased air pressure.

Further, physically speaking, air has motion, temperature and water vapour content, all of which vary widely.

From the physiological standpoint, the atmosphere has two distinct functions: firstly, the supply of oxygen for body processes and the removal of the products of combustion, carbon-dioxide and water, and secondly, the control of body temperature. Heat loss from the body is accomplished by radiation, convection, and by evaporation of perspiration when heat production is excessive.

### *Importance of the Cooling Power of the Air*

It has long been recognized that the air of closed places in which people congregate frequently becomes unpleasant to live in; that symptoms of fatigue, lassitude and inability to do the ordinary amount of work appear

*\*Presented at the Twenty-Third Annual Meeting of the Canadian Public Health Association, St. John, N.B., June, 1933.*

in those occupying such places; and that, finally, death may occur in extreme cases of overcrowding, as in the well-known case of the "Black Hole of Calcutta".

Attempts were, of course, made to explain these phenomena, and up until 1905 interest centred around the chemical or respiratory exchange factor, to the almost complete neglect of the physical or heat interchange factors. The discomfort or malaise suffered in ill-ventilated rooms was ascribed to exhaustion of oxygen, to increase in carbon dioxide content, and, finally, to the existence of a supposed poisonous organic substance in the expired air. Air analyses did, of course, show a very slight decrease in the oxygen content and a rise in the carbon dioxide content, but it was concerning the presence of this poisonous organic substance that the controversy raged all through the nineties of the last century. The literature is full of contradictory results of the effect of exposing laboratory animals to the expired air of other animals.

Brown-Séquard and d'Arsonval(1) were the principal protagonists of the organic poison theory: they condensed the moisture of the expired breath and injected it into the veins of rabbits, with fatal results. Later, they confined rabbits in a series of jars connected by rubber tubing through which a current of air passed in a constant direction. In this way, the rabbit in the last jar received the expired air of all the others. In their experiment, this rabbit always died first, followed in order by the second last in position, and so on. If an absorption tube containing concentrated sulphuric acid was placed between the second last and the last jar, the rabbit in the second last jar died first. From these experiments they deduced the presence of an organic poison in the expired breath which was absorbed by concentrated sulphuric acid. These experiments were repeated with entirely negative results by a large number of workers, including Haldane and Smith, Beau, Rauer, Lübberd and Peters.

Finally, about 1905, began the work which led to our modern conception of the ill effects of vitiated air. The experiments conducted were both destructive of the older ideas and illuminating as to the true underlying causes of discomfort in ill-ventilated places.

The truth had been suspected by Haldane and Smith (2) and by Billings, Mitchell and Bergey (3), but the most convincing proofs were brought forward by a group of workers under the direction of Flügge (4), Director of the Institute of Hygiene at Breslau, and by Leonard Hill (5), of London. The experiments of both these groups of workers were practically the same. They confined a group of students in an enclosed chamber until the oxygen content of the air therein had fallen to about 17 per cent, and the carbon dioxide content had risen to  $1\frac{1}{2}$ , 3 and even 4 per cent—values never even approximated in any room, no matter how poorly ventilated. In these extreme conditions the subjects began to show some signs of distress, but the surprising fact was noted that if the same air was set in motion by an electric fan inside the chamber, the signs of distress at once vanished and the men were as comfortable as ever. Again, with their bodies still in the stagnant air of the chamber with no fan going, they were not relieved by breathing air from outside through a tube. Finally, an outsider breathing the air of the chamber through a tube, with his body in comfortable conditions outside, experienced no discomfort. Coupled with these convincing experiments are the fruits of deductive reasoning from matters of everyday knowledge. Men employed in breweries often work continuously in air which contains up to 2.5 per cent of carbon dioxide without discomfort or ill effect; and the air of mines is often deliberately kept down to an oxygen content of 17 per cent to diminish the danger of explosion. The men in submarines have an even lower oxygen content rationed out to them, and as

long as the air is cool and kept in motion, they suffer no discomfort.

All these things have led us now to the belief that the important factor in ventilation is not that of respiratory exchange depending on the proportion of oxygen and carbon dioxide in the air, but that the question of greatest importance is the cooling power of the air, depending not on its chemical composition, but upon its physical properties of temperature, motion and water content.

The New York State Commission on Ventilation (6) undertook the study of the ability of men to work under various conditions of temperature and humidity. It had been argued that men may be able to do as much work under conditions of high temperatures, but that they simply do not feel like doing so. In order to obviate this objection, the men were offered proportionate rewards for the number of times they could lift dumbbells. At a temperature of 75°F., with a relative humidity of 50 per cent, only 85.2 per cent as much work was done as at a temperature of 68°, relative humidity of 50 per cent.

Lest there be any misunderstanding, let us make ourselves perfectly clear at this point. We do not minimize the importance of fresh, clean outside air, nor do we advocate that an electric fan be substituted for a supply of fresh air. We do recommend, however, that everyone in any way responsible for ventilation should understand thoroughly the most important reasons underlying the need for fresh air, so that each may be in a position to operate his system intelligently and not defeat these prime objects by some error, and so that he may learn how to measure accurately the effectiveness of his ventilation. No matter how many thousand cubic feet of clean air are hourly supplied to a roomful of school-children by an elaborate fan system, if this air is delivered too hot and too moist, the children will continue to doze blissfully through their study periods.

Granted, therefore, that the impor-

tant factor in ventilation is the cooling power of the atmosphere, let us examine in more detail the physical properties of the air upon which this cooling power depends.

The body loses heat by radiation, by convection (the action of air current in removing the heated layer of air about the body) and, especially when heat production is great, by evaporation of perspiration. The cooling power of the air, therefore, depends on its temperature, its movement and its relative humidity; that is, the amount of water vapour it contains relative to the amount which would saturate it at the given temperature. By the alteration of any one of these factors, it is possible to change markedly the cooling power of the atmosphere. For example, when on a hot day with a high relative humidity, we are perspiring and struggling to keep down our body temperature, what a relief we experience when we get close to an electric fan. It is to artificial air movement that we will have to turn in the solution of the problem of textile and tobacco workers, who, for the good of the product in course of manufacture, must work in air of high temperature and moisture content.

#### *The Kata Thermometer and its Use*

The measurement of each of these factors of heat, humidity and air movement separately by means of the ordinary thermometer, the wet and dry bulb thermometer and the anemometer, respectively, is a matter of common knowledge to all. They are all, of course, useful instruments in the study of air conditions. It is to Leonard Hill (7), however, that we owe the development of the kata-thermometer, an instrument which is used to determine numerically the total cooling power of the air and, therefore, our degree of comfort.

The kata-thermometer is an alcohol thermometer specially designed to obtain suitable readings. The bulb consists of a cylinder, 2.2 cms. long and 1.8 cms. in diameter, the top and bottom of the bulb being hemispherical.

The stem has only two marks upon it, representing 95° and 100° F., respectively. The bore of the stem is enlarged at the top so that it may be heated to a temperature well above 100° F. without breaking it.

The instrument is heated up well above 100° F. by immersing it in hot water; it is then carefully dried and hung up, and, with a stop watch, we determine the time it takes to cool from 100° F. to 95° F. The amount of heat lost by such cooling is, of course, always the same for a given instrument. This amount of heat is determined by the maker and is divided by the surface of the bulb expressed in square centimetres; the result—that is, the number of milli-calories per square centimetre lost when the instrument is cooled from 100° to 95° F.—is known as the factor of the instrument and is marked on each stem thus, F.—473. If we divide this factor by the number of seconds which it took to cool from 100° to 95° F., we obtain the cooling power of the air at that particular point expressed in milli-calories per square centimetre per second.

The instrument is used in two ways, the so-called dry-kata described above, and the wet-kata, which is the same device with a small silk-mesh cover applied over the bulb. In using the latter, we heat the thermometer in the same way, wipe off the excess moisture, but leave the slightly wet silk-mesh cover in position while the thermometer is cooling. The dry-kata readings are influenced both by temperature and air movement; the wet-kata by temperature, air movement and humidity influencing heat loss through evaporation. The latter is particularly used in measuring the cooling power of the atmosphere under those conditions where the body calls into play its powers of cooling through evaporation and sweating occurs.

So much for the methods of estimating the cooling power of the atmosphere in a given place. A great number of readings by the kata-thermometer have been taken under

widely different conditions of temperature, humidity and air movement, and these readings correlated with the sensations of comfort and ability to do work of experimental subjects exposed to the same conditions. As a result, we feel fairly certain of the cooling power as measured by the kata-thermometer proper for different classes of workers. For instance, for sedentary workers the atmospheric conditions most conducive to comfort and efficiency are those which produce a cooling power of 5-6 milli-calories per square centimetre per second, as measured by the dry-kata, and of 14-17, as measured by the wet instrument. A much higher cooling power is, of course, indicated for people doing manual work.

#### CONCLUSION

The principles underlying good ventilation are simple, understandable to everyone and in keeping with our every-day experience of comfort and discomfort. A knowledge of these underlying principles and a close familiarity with the few instruments involved are most necessary qualifications of those who are responsible, in any way, for the maintenance of good ventilation.

#### REFERENCES

- (1) Brown-Séquard et d'Arsonval: Nouvelles recherches démontrant que la toxicité de l'air expiré ne dépend pas de l'acide carbonique. *Compt. rend. Acad. d. Sc., Paris*, 1889, CVIII, 267-272.
- (2) Haldane, J. and Smith, J. L.: *The Toxic Action of Expired Air*. J. Path. and Bact., Edinburgh and London, 1892-93, I, 318-321.
- (3) Billings, Mitchell and Bergey: *The Composition of Expired Air and its Effects upon Animal Life*. Published by the Smithsonian Institution, 1895.
- (4) Flügge: *Ztschr. f. Hyg.*, 1905, XLIX, 363.
- (5) Hill, Leonard; Rowland, R.A.; and Walker, H. R.: *The Relative Influence of the Heat and Chemical Impurity of Close Air*. London Hospital Medical College, J. Physiol., LXI, 1911.
- (6) *Some Results of the First Year's Work of the New York State Commission on Ventilation*. Am. J. Pub. Health, Feb., 1915, Vol. V, No. 2, 85-118.
- (7) Hill, Leonard: *The Science of Ventilation and Open-Air Treatment*. Parts I and II, Medical Research Council's Special Report; Series Nos. 32 and 52. H.M. Stationery Office, 1919.

